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ARCHIVES OF OPHTHALMOLOGY.

CONTRIBUTIONS TO CLINICAL OPHTHALMOLOGY: BEING GLEANINGS FROM MY CASE-BOOKS.

By SWAN M. BURNETT, M.D., Ph.D., Washington, D. C.

(*With six illustrations.*)

(*Continued from p. 262, vol. xxi.*)

EYE AFFECTIONS FOLLOWING LA GRIPPE.

TO the literature of eye affections following epidemic influenza, I can contribute the following cases:

Case X.

RETROBULBAR NEURITIS IN A NEGRO FOLLOWING LA GRIPPE, SUCCEEDED BY ATROPHY AND GREAT NARROWING OF THE VISUAL FIELDS.

Taylor Triplet, a colored man, twenty years of age, was seen at my clinic first on June 6, 1891. He had had an attack of *la grippe* two months before, and on convalescence had noticed that something was wrong with his eyes. He had at the time a central vision $= \frac{5}{6}$ in either eye. Visual fields as in diagrams Fig. 9 A and B. Inside of this field color perception was good.

The ophthalmoscope revealed nothing abnormal, except, perhaps, a slight blanching of the nerves at the upper outer quadrants. The patella reflex is not good, but he stands well with his eyes shut, and can walk backwards. There is no pain in the head, and he does not remember that there was any unusual pain in the eyes or orbits during the attack of influenza. His intellectual faculties are the same as before the attack. No history of syphilis can be elicited.

He was not seen again until November 16th, when he was led to the clinic, not being able to find his way about alone. His

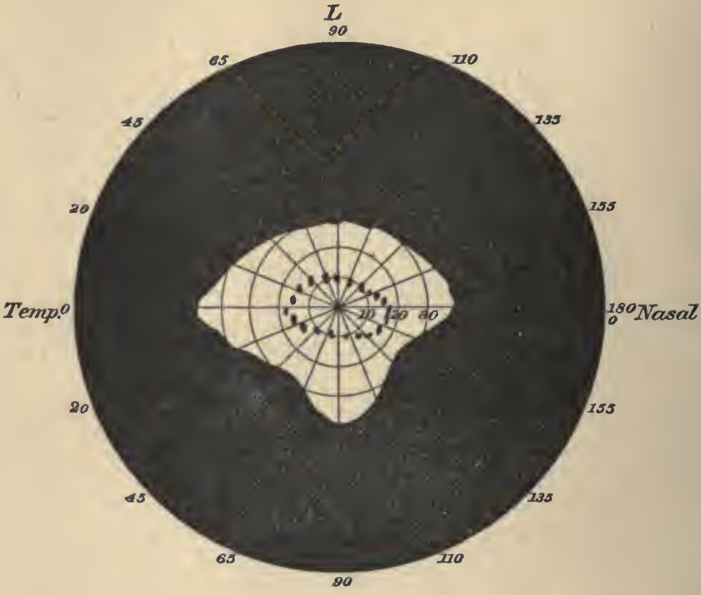
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FIG. 9.—A.

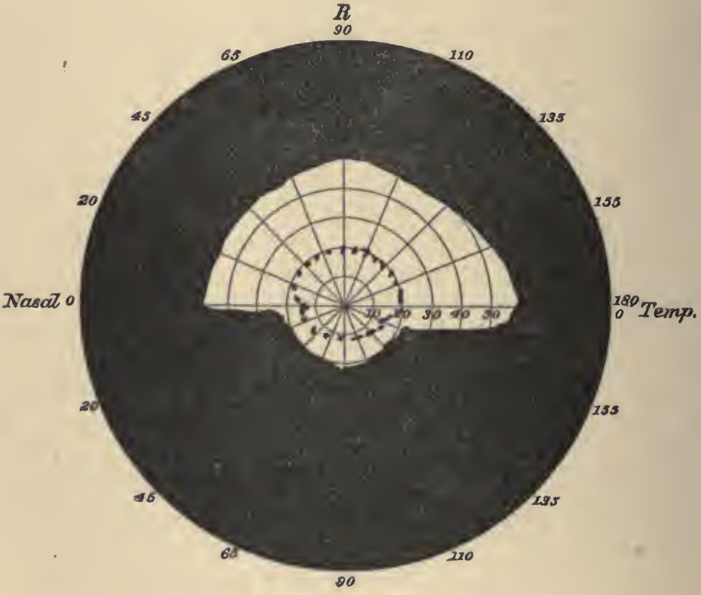
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FIG. 9.—B.

visual fields were then contracted to the inner dotted circle in the diagrams. Central vision was $\frac{6}{15}$ L, $\frac{6}{20}$ R, and colors were correctly distinguished. Both disks were now white, but the retinal vessels were normal as to number and size. There were some capillaries on the disk surfaces. On December 3d the fields had contracted to less than 10° in both eyes, but he could still distinguish single letters of No. 18 at 5 *m*. Color perception within this limit was good. He disappeared and has not been seen since.

Case XI.

RETROBULBAR NEURITIS, ATROPHY. LATERAL DIPLOPIA, CURED.

James Eastman, a negro of thirty, was taken with *la grippe* on November 30, 1891. The attack was rather severe. About Christmas-time he noticed trouble with his eyes, preceded by some pain in the back of the head. There was lateral diplopia and dimness of vision. The diplopia ceased to be noticeable in March, but the failure in vision continued to increase until, at the time of examination (June 10, 1892), there was barely perception of light. The pupils are of medium size and respond feebly to light. Movements of the eye and lids good; media clear. The disks are white and rather dirty-looking; outlines not very sharp. Retinal arteries much narrowed in calibre; veins about normal in size and not tortuous. There is quite a noticeable white streak along each side of all the large vessels, which extends even on to the surface of the disk. In the right eye some small white dots and oblong patches are seen to the lower and outer side of the disk, mostly along or in the vicinity of the blood-vessels. The patient's general health is, and has always been, good, and there are no signs of ataxia.

Case XII.

ATROPHY OF BOTH OPTIC NERVES FOLLOWING LA GRIPPE.

Smith Jackson, colored, age twenty-eight, had influenza in February, 1891. A month afterwards he noticed that vision was failing, and the failure has been gradually increasing until now (four months after the first symptoms were noticed) he counts fingers at three feet with either eye. The visual fields are much contracted concentrically. The disks are white, with good sharp outlines, and the retinal vessels are but little, if any, changed. The tendon reflex is good.

CASE XIII.

CENTRAL SCOTOMA IN ONE EYE FOLLOWING LA GRIPPE.

Mrs. S. E. J——, aged forty, seen first May 26, 1891. Had *la grippe* in the early spring, and on convalescence noticed that vision in the right eye was bad, and that there was a "spot" before it, through which objects look blurred and oftentimes of a reddish color. Vision in that eye = $\frac{5}{24}$, and, under a mydriatic, was increased to $\frac{5}{18}$ by a + 0.75. Fundus seemed normal. She also has homonymous lateral diplopia at the extreme left upper field of fixation. The scotoma has a diameter of 5 *cm* at a distance of 50 *cm*. The visual field is slightly contracted. She was under observation for a month, during which time no change in the condition was noticed.

Besides acting directly and primarily as a cause of neuritis, it would seem that the poison of influenza also hastens the operation of other causes of neuritis, as it does of those of other diseases, tuberculosis in particular. The two following cases would seem to be instances in point.

CASE XIV.

COMPLETE ATROPHY OF BOTH OPTIC NERVES IN A MAN WHO HAD BEEN A HEAVY SMOKER, AFTER AN ATTACK OF LA GRIPPE.

J. H. M——, thirty-eight years of age, seen for the first time November 14, 1891. Nine months before he had had an attack of influenza in which the pain was mostly over the left eye, and immediately after noticed a decided failure of vision in the left eye, which has gradually increased until he can now count fingers only at 2 *m*. Vision in L eye, $\frac{5}{12}$.

Six years ago he had a paralysis of the left external rectus, after a blow on the left side of the head, which disappeared in the course of seven months. He had some diplopia again on recovering from *la grippe*. There is no history of specific infection. His wife has had four children; one died of small-pox, another of meningitis, the two living are healthy. The V F in left is contracted; in the right it is about normal. In the left the optic disk is grayish-white, and slopingly excavated all around. There are but few vessels on the disk. In the R the atrophy and excavation are confined to the outer side, the inner side being on a level with the fundus. With the left he recognizes blue and green, but confounds red and light yellow. Colors in right normal. He has been a great consumer of cigars, smoking often as many as thirty daily. At time of attack smoked regularly six pipes a day. He was seen again July 16, 1892, and in the meantime had seen surgeons in New York and Philadelphia, who had treated him with strychnia and bichloride. He had gotten steadily worse, so that now there is only perception of light in left, and in right $V = \frac{3}{60}$. Left pupil widely dilated and immovable. The right disk is bluish-white and slopingly excavated ; vessels do not appear to be greatly changed.

CASE XV.

FAILURE OF VISION AFTER LA GRIPPE IN A MAN WHO SMOKED RATHER EXCESSIVELY.

Mr. A. P. F——, age fifty-six. Had an attack of influenza two years ago, complicated with pneumonia. In November, 1891, he had another, in which the gastric and intestinal symptoms were most prominent, and, being in the South at the time, he took 100 grains of quinine in ten days. On January 1, 1892, he observed that his vision was failing. There was no pain in the eyes, but he noticed flashes of light when he was in the dark. At the time of examination, March 6, 1892, vision $= \frac{5}{60}$ in either eye, with $+ 2 = \frac{5}{24}$; but all objects have blurred outlines. Visual fields for white somewhat contracted concentrically, as were also those for colors. Central color perception good ; no specific history could be elicited, and the tendon reflex was good. There was no change in the fundus which could satisfactorily account for the diminished vision. The disks were of good color and the retinal vessels were normal. He was put upon strychnia, $\frac{1}{60}$ gr. three times a day, and this was continued for a month. At the end of that time there was no essential improvement. It was then learned for the first time that he smoked more than moderately, sometimes as many as eight or ten cigars a day. His smoking was stopped, and in the course of several days an improvement was noted. This continued, with occasional slight relapses, until it reached almost the normal when last seen some four months after the first visit.

CASE XVI.

SUDDEN BLINDNESS IN LEFT EYE AFTER LA GRIPPE.

Chas. F——, colored, age thirty-one, seen first May 12, 1891. Had *la grippe* this spring, and on convalescence noticed one day that he was blind in the left eye. During his illness he had great pain in the left temple, which radiated towards the left ear. In this eye the visual field is entirely lacking, except at the upper and inner part. The media are clear; the disk is paler than its fellow and slightly excavated. The other eye is normal.

I have notes of a number of cases of paresis of the various ocular muscles, which showed itself as a succedaneum of influenza. Sometimes but one muscle was attacked, but frequently two or more. In the majority of cases these had a happy issue in complete recovery.

There have been, in addition to these, a number of cases of heterophoria with asthenopia and other nervous symptoms, in which the trouble as regards the eyes and head dated from an attack of the disease.

CASE XVII.

HEREDITARY CONGENITAL OPTIC-NERVE ATROPHY.

Cases of this peculiar affection are not so commonly met with as to make the report of other instances without interest, particularly in view of the fact that we are not yet certain that all the cases should be placed in the same category. Many of those reported have been instances of optic neuritis, some of them coming on a number of years after birth. In the cases here reported it would seem that, some at least, of those afflicted were born with the amblyopia upon them, and we are not able in such a case to say how far arrest in development may have operated as a cause. The presumption, however, seems to be in favor of a neuritis, possibly intrauterine. The fact that it is hereditary and that the neuritis appears for the most part in young people would seem to show that the developmental processes are at least defective and play an important *rôle* in all cases.

Scott Holt, aged twelve, was seen for the first time on May 1, 1892. He was sent to me from the country by his physician in order to have glasses fitted for the improvement of his vision, which was very bad. On examination I found that he could count fingers only at one metre's distance with either eye, and, according to the statement of his mother who accompanied him, he had never seen any better. There was a white atrophy of both disks, but no marked excavation. The retinal vessels were normal in number and size. The visual fields were much contracted for form. In testing with Holmgren's worsteds he mixed grays and blues with green, and the browns and olives with pink. The teeth were good and there was no evidence of inherited disease. The ophthalmoscope showed emmetropia.

CASE XVIII.

OPTIC-NERVE ATROPHY IN THE MOTHER OF THE FORMER PATIENT AND HER FAMILY.

After the examination of the son was finished the mother informed me that her vision was also defective, and on testing I found it to be $\frac{3}{60}$ in either eye. The optic disks were bluish-gray, but of good outline. The retinal vessels were normal. Visual fields contracted for form. Color-test gave a mixing of gray and blue with green ; salmon, yellow, green, and purple with pink ; purple and green with blue. She does not remember that her vision has ever been better than it is now.

On inquiry I learned that very defective vision was common among her relations on her mother's side. Her mother's vision had been about the same as her own, and her maternal grandfather also saw very badly ; and in all there were five uncles and aunts on her mother's side who were known to have had impaired sight, and, presumably, due to the same cause. In her father's family, as far as known, there were no instances of markedly bad vision.

TENONITIS AND ORBITAL CELLULITIS.

While orbital cellulitis in not an uncommon affection, it is not of so frequent occurrence as to render some points of the following cases devoid of interest.

CASE XIX.

TENONITIS.

I was asked by Dr. Mauss to see with him a girl of eleven years on the 2d of March, 1891. He had been called to her the day previous and learned that three days before she had complained of a slight headache and the parents noticed a swelling of the right eyelids. She had been in good health and no cause could be assigned for the trouble. There was no history of a blow or any traumatic injury. There was, when I saw her, a marked exophthalmos directly forward, some slight swelling and redness of the lids, and a chemosis of the ocular conjunctiva, quite pronounced below. The globe was absolutely fixed, there being not the slightest movement in any direction ; pupil dilated and immobile ; vision much reduced, and some slight pain at times on that side of the head. Temperature normal. The media were clear, but the sharp outlines of the disk were lost. The retina looked swollen, grayish, and infiltrated ; no redness distinguishable in the fundus ; veins a little swollen but not very tortuous ; no hemorrhages. On the 3d I made punctures, under chloroform, into the orbit, through the lids above the inner canthus and between the outer canthus and the chemotic conjunctiva, going by the side of and back of the globe. Bloody serum escaped, but no pus. Temperature still normal. On the 4th the ophthalmoscopic picture was the same, but there was a slight movement of the globe up and down. On the 5th there was greater movement, and a flow of tears, for the first time since the attack. The fundus appeared somewhat red and more vessels were visible. Mercurial inunctions were ordered and a blister applied to the temple. On the 7th the exophthalmos had perceptibly diminished, but there was still no movement outward. On the 9th, the retinal vessels were much larger and the outlines of the disk were faintly seen and there was a slight movement of the ball outward. On the 11th the disk was clearer, but the movement outward was still very slight. Improvement continued steadily, so that on the 19th, when she was examined at the office, vision in the right (affected) eye was $\frac{5}{18}$, that in the left being $\frac{5}{5}$; pupil smaller and responsive to light ; disk quite clear in outline and only a slight tortuosity of the vessels. Ophthalmometric examination of the cornea showed nothing different from that of the fellow eye. 29th, diplopia in the outer fields of fixation, vision right $\frac{5}{6}$. April 12th, diplopia only at the extremes of fixation fields; vision $\frac{5}{5}$. Sept. 18th, an exophoria of 2 P. D. both for near and far.

It is claimed that we can draw a clear line of distinction between orbital cellulitis and tenonitis, and if we can, this case would certainly fall, I think, in the category of tenonitis, and would be of the serous form. In tenonitis we would have the pressure closer around the globe, involving all the muscles, producing absolute immobility and the exophthalmos would be directly forward. The pressure on the nerve and its vessels would also be more direct than in the case of abscess, unless the abscess were situated in its immediate vicinity. The cause of the inflammation in this instance I cannot even surmise. Such cases have been referred to *la grippe*, but this case occurred before the epidemic of *la grippe* appeared among us in 1891. It made its appearance that year in April, and, besides, there was at no time any febrile or other systemic disturbance; the trouble remained purely local. It is not without interest to note the complete recovery of the retina from a very intense serous infiltration, and also the entire absence of hemorrhages, which are so commonly an accompaniment of mechanical obstruction to retinal circulation.

Quite distinct from this case in its clinical aspects is the following, which is one of ordinary cellulitis, probably metastatic, ending in abscess.

CASE XX.

ORBITAL ABSCESS.

A man of twenty-five years was admitted to Garfield Hospital for a fever supposed to be malarial. He also had a stricture of urethra which he was waiting an established convalescence to have treated. On the 19th Dec., 1891, he complained of pain in the upper maxilla of the right side, and within ten hours there was a great swelling of the lids and an exophthalmos somewhat downward and outward. The eye was very tender to the touch, conjunctiva was chemotic below, and there was a slight discharge of muco-pus. Movement of the eye limited in all directions. Temperature reached 101° that day. The pupil had been dilated by atropine, the fundus was normal, and the vision good. On the 22d, a painful swelling appeared on the left wrist. There was no indication of a pointing of an abscess in the orbit; temperature from 99° to 101°; treatment, hot applications externally. I was unable to see him again until the 26th, when I found that the abscess had pointed above the inner canthus and discharged a quantity of pus. It was kept empty by pressure on the globe backward and inward. On the 29th I opened another abscess pointing below the inner canthus. The movements of the eye good and vision unimpaired. On Jan. 20, 1892, the sinus had healed and the eye was in a normal condition. The abscess at the wrist was still discharging.

CASE XXI.

TWO ATTACKS OF DOUBLE PAPILLITIS IN THE SAME PATIENT.

I much regret that the notes of the following case, recorded at the time, were lost, but the essential facts were as follows:

A colored woman of thirty was seen at my clinic for the first time about seven years ago. She had then very marked double papillitis and the vision was very much impaired though she could see to get about alone. The only complaint she made at that time was of headache, which was quite steady and had been for some time. There was no paresis or paralysis. Her intelligence was of a low order, and a clear clinical history could not be obtained. There were no signs of central nervous disease discoverable aside from that above stated. Thinking that specific disease might be at the bottom of the trouble, though the history pointed very indefinitely in that direction, she was put on specific treatment, and in the course of some weeks the papillitis began to subside. After four or five months there was scarcely a trace of it left, and her vision was vastly improved. Three years later she returned, and there was a full-blown papillitis in both eyes, accompanied by a more serious impairment of vision than before. She was unable to go about alone. There was no paralysis, but her mental condition had deteriorated sadly, and she complained of an incessant headache. She was not able to give any intelligent account of herself or her symptoms, and in a short time departed and we were unable to find her.

I have on more than one occasion seen papillitis, which was due undoubtedly to intracranial trouble, subside, but, so far as my own experience goes or my examination of the literature allows me to judge, cases of a second attack must be very rare, though I see no reason *a priori* why they should be. The intracranial conditions which lead to the papillitis are, as we know, very fluctuating, and the cause which leads to one attack would certainly be liable, when renewed, to bring about the conditions for the renewal of the neuritis.

CASE XXII.

GUMMATA OF THE CILIARY REGION.

Two reasons have led to the reporting of the following cases. The first is that instances where gummata of the eye have come to enucleation and examination, though there are several cases on record, are not so common as to render further contributions to their study altogether superfluous, since the manifestations of syphilis in the eye is always a matter of serious moment when the possibility of its issue is considered. The second is the fact of the rapidity and malignancy with which these growths developed, and particularly when this is taken in connection with their appearance in negroes, in whom all syphilitic manifestations are much milder and more easily controlled than in the white race. The latter statement as to the mildness of syphilis in the negro may be new to some, but it is one which is supported by my own experience in an eye-clinic in which three fourths are of the African race, and by the experience of my surgical friends whose practice is among the same class. The only explanation of this that I have heard offered is that this race, through its proneness to suppuration at the initial lesion or at the glandular implications, either absorbs less virus or throws it off more readily than does the white race. On this point, however, I think we are in need of more substantiating proof, for my own observations will not allow me to grant a greater proneness to suppuration, at least in the eyes of the negro, either from inflammation or after operation.

Joseph S——, colored, aged twenty-three, came to the clinic for the first time on November 2, 1888. He then had a simple iritis of the right eye. He gave a history of an initial lesion some four months previously. There was no eruption, and he said there had been no considerable enlargement of the inguinal glands. The post-cervical glands were swollen. He was put on the usual specific mixture, and ordered atropine drops. On the 15th a gumma was noticed on the iris at the outer lower pupillary edge. The dosage of the specific mixture was increased, but the increase in the inflammatory process was so rapid that he was sent to Garfield Hospital for better care and more vigorous treatment. On the 28th an hypopyon appeared and the general condition of the eye was so much worse that he was put upon a vigorous course of deep muscular injections of sublimate and inunctions. In spite of this, on the 30th, a swelling 3 *mm* long made its appearance in the upper ciliary region. The injections and inunctions were continued, but with no apparent effect on the eye, which was frightfully painful and required the constant use of opiates for relief. The swelling increased slowly, and the eye took on a generally disorganized look. The patient appealed so persistently for a removal of the eye on account of the pain that I acceded to his request and the eye was enucleated on the 22d of December.

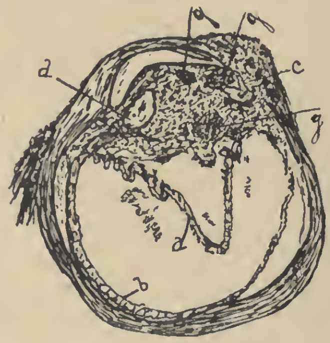


FIG. 10.

The eye after hardening in Müller's fluid was cut by Dr. Wm. Gray, of the Army Medical Museum.

An antero-posterior section through the ball of the eye is given in Fig. 10. The sclera is intact except at the ciliary region where the growth has pushed its way through both it and the cornea at *c*. The cornea and sclera on the other side seem in a fairly normal condition. The growth has thrust itself inward to the back of the lens, *d.* The section is through the middle of the growth, and consequently the lens is cut near its equator, which has been somewhat dislocated to the other side. The ciliary body on this side also participates to an extent in the morbid process. The choroid, *b*, is detached except at the posterior part, and the retina, *a*, is wholly separated and drawn far forward, and is implicated, in its anterior portion, with the growth. The growth itself is not uniform in structure, but presents areas, *g*, of greater density than the surrounding parts and which are quite clearly circumscribed.

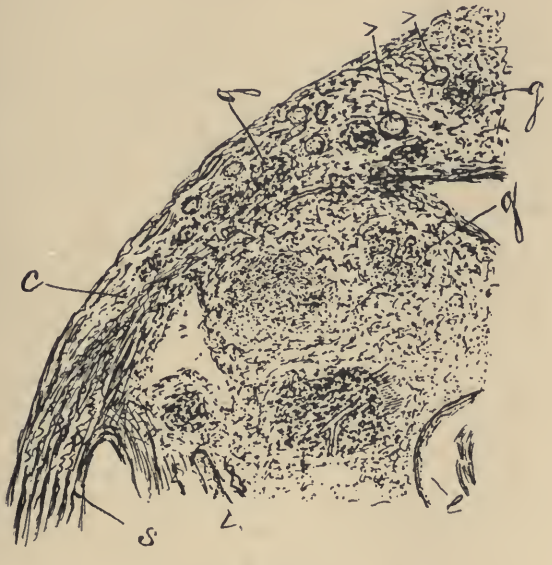


FIG. 11.

A magnified appearance of a portion where it passes out through the cornea is shown in Fig. 11.

The sclera, *s*, is seen to be in fairly normal state, and so is the cornea, *c*, immediately adjoining. At least they are not involved in the special pathological process. The mass is composed entirely of small round cells with only a few connective-tissue fibres. At the spots of greater condensation, *g*, they are so far reduced in size as to be almost amorphous, and are evidently the beginnings of a process of breaking down. In these there is no connective tissue whatever. Macroscopically these spots have an appearance not unlike the giant cells of tubercle. The larger part of the mass itself is not vascular, but in the degenerated corneal and in the choroidal and ciliary tissue there are numbers of vessel, *v*, in all of which there is abundant evidence of a thickening of the vascular walls. In fact, all the vessels wherever seen show signs of a vasculitis. The capsule of the lens, *l*, is intact.

The other eye was not attacked, and when the patient was seen for the last time some months after the enucleation, there was no evidence of the disease apparent.

Case XXIII.

H. J., colored, aged eighteen, was admitted to the clinic January 4, 1889, with the diagnosis of specific iritis of the left eye. He said that he contracted the initial lesion in July, 1888, and was treated at the Freedman's Hospital for secondary eruption in September. In November the eye was inflamed for the first time. Since then it has been painful at times and latterly almost continuously. There were the signs of an iritis of rather unusual severity, and he was put upon strong specific treatment. At the end of a week a swelling was noticed at the upper ciliary region, and he was sent at once to the Garfield Hospital and submitted to the same treatment by inunctions and deep muscular injections of bichloride as in the preceding case, but with as little avail. The pain complained of by these patients was most excruciating and continuous, and this one, too, begged for an enucleation, which was done on March 30, 1889.

The accompanying drawing (Fig. 12) shows the relative situation and size of the growth immediately after enucleation. The microscopical section did not reveal anything essentially different from the preceding case. He was discharged from the hospital

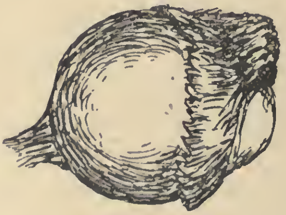


Fig. 12.

April 5th, and we have heard nothing from him since, as we would have done had there been a return of the trouble in the other eye.

CASE XXIV.

DOUBLE SYMMETRICAL UPWARD CORECTOPIA.

Manz in his classical treatise on malformations of the eye in Gräfe and Sämisch's *Handbook*, vol. ii., says that corectopia of high degree in which the pupil is displaced from the centre and drawn far towards the edge of the cornea is rare, and that the displacement is usually downward and inward; and further, that cases of "pure" corectopia in which the iris structure has undergone no changes are very uncommon and of great interest as bearing upon the question of the connection of such displacement with coloboma.

I give the accompanying drawing (Fig. 13) therefore as a representative of such rare conditions. It was in the person of a girl of three years, who was brought to my clinic by her mother, June 26, 1892. The pupil in both eyes was drawn, as shown in the figure, directly upward and reached almost the edge of the cornea. There was, however, a small bridge of iris tissue left at this place. The pupil was unusually small for a child of that age, and was by no means active. The vision seemed to be fairly good. Under atropine, 2 per cent., the pupil dilated to the dotted lines shown in the drawing. The fundus under ophthalmoscopical examination revealed nothing abnormal. There was no coloboma of the choroid, nor any displacement of the lens that could be discovered.

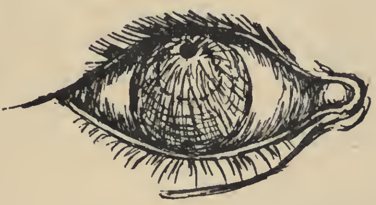


FIG. 13.

SIMPLE METHOD OF OPERATING FOR PARTIAL TENOTOMY OF THE RECTI MUSCLES (GRADUATED TENOTOMY).

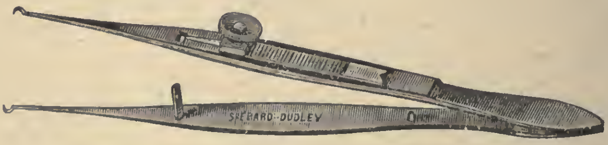
By EUGENE SMITH M.D.,

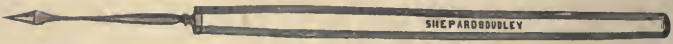
PROF. OF OPHTHALMOLOGY AND OTOLOGY IN THE DETROIT COLLEGE OF MEDICINE, ETC.

(*With two wood-cuts.*)

SEVERAL years' experience in the following simple manner of making partial tenotomy of the recti muscles in heterophoria, leads me to give it to the profession with the remark that it is as effective as it is easy.

The instruments required are an ordinary eye speculum; a small triangular corneal knife—the stop-keratome of De Wecker; and a peculiar ring forceps, each branch of which ends in a sharp hook. When closed the forceps form a small ring at the points. (See cuts.)





After cocainization, the eyelids are held open with the speculum, the belly of the muscle is seized at the equator of the eye while the patient looks in the direction opposite to the muscle to be operated on, *i. e.*, inwards if the external rectus is to be cut.

The full width of the muscle and the conjunctiva over it are seized with the forceps, the sharp points of which pierce the conjunctiva and grasping the muscle hold it securely in the ring. The muscle is then drawn away from the eyeball in such a manner as to put the tendon on the stretch, while the point of the triangular knife is pushed through the conjunctiva and centre of the tendon at its attachment to the sclera. If, in the judgment of the operator, the division of the tendon made by the forward movement of the knife is deemed insufficient, or found to be so on testing, the muscle is again seized with the forceps, the knife entered by the same wound in the conjunctiva and tendon, and by lateral movements the tenotomy is enlarged.

The very small wound in the conjunctiva usually closes by its own elasticity. The bleeding or effusion beneath the conjunctiva is very slight, and seldom does over-correction occur.

The pain is slight, and the operation quickly made, a desideratum of more import to the patient than to the operator. No dressing is required.

THE DIAGNOSIS OF SYMPATHETIC OPHTHALMIA.

BY DR. LEOPOLD WEISS,

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Translated by Dr. CASEY A. WOOD, of Chicago.

AT the last meeting of the Ophthalmological Congress at Heidelberg, it was held by several speakers[1] that not infrequently it is difficult to decide whether an inflammation in the second eye, occurring some time after an injury to the first, is or is not a true sympathetic ophthalmia.

It is self-evident that cases of this sort are of great importance to accident insurance companies, because if it be admitted that a wound of one eye has endangered the vision of the other, the injured man would have a just claim for increased compensation.

Having in view the great practical importance of this question, I submit the following cases.

CASE I.—Heinrich E., æt. twenty-eight, boiler-maker, was, Feb. 11, 1887, severely injured in the left eye by a piece of wire. The fragment penetrated the cornea, and passed through the iris into the crystalline. Whether it imbedded itself in the latter, or went through it into the vitreous, it was impossible to say at the time of the first examination, owing to the cloudiness of the lens. Vision was reduced to perception of light.

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[1] *Transactions of the Oph. Congress*, pp. 100–113. Schweigger stated that there are no objective signs by which one may recognize the sympathetic character of an irido-choroiditis.

The patient was admitted to hospital, and attempts were made to preserve the eye. During the next few days, however, such marked inflammatory symptoms appeared in the injured organ, and the other one became so sensitive to light when the bandages were changed, that the left eye was enucleated on the 16th of February. Everything progressed favorably, and the patient was discharged February 24th. At this date the right eye was free of irritation, and had normal accommodation and visual acuity. Towards the end of March he was fitted with an artificial eye, but did not return to work until the beginning of October, 1887. During this period he received full benefits; afterwards he was paid one third—the amount allowed for the loss of one eye, the vision of the other being good. E. worked about nine months without complaining of any trouble with his eyes.

At the end of August, 1889, patient returned, saying that for some time past he had not been seeing so well, and that recently it was getting quite noticeable, especially when he had fine work to do. On such occasions he was obliged to strain his eye.

Vision was at this time $\frac{6}{36}$. Pupil reacted promptly to light. The eye was neither markedly painful nor tender, although slightly sensitive to pressure. The ophthalmoscope revealed no gross changes, and yet the uniformly rosy papilla, with its indistinct edges, accompanied by a faint cloudiness of the whole fundus, gave rise to the suspicion of a beginning neuro-retinitis. The stump is not tender on pressure.

The patient was again admitted, and treated by the dark chamber and mercurial inunctions. In consequence of this, the visual acuity at first improved, then it came to a standstill, and later it again declined.

As the disease progressed well-marked alterations showed themselves in the fundus. The disk became paler and paler, and some of the central vessels are edged with white. In the background proper are small bright yellowish-white dots, accompanied by changes in the fundus pigment. In December, 1888, $V = \frac{6}{\mathrm{ix}}$ to barely $\frac{6}{\mathrm{xxxvi}}$. The field of vision was of almost normal extent, although red and green were not correctly named. Urine free from albumen.

In response to a request from the benefit society for my opinion, I expressed myself as follows: In passing judgment upon this rather obscure matter we are met at the outset by the query: What causal connection, if any, is there between the injury to the enucleated eye and the serious disease in the other eye which did not set in until a year and a half afterwards? Is the affection of the remaining eye to be regarded as a sympathetic ophthalmia?

Along with this question we may consider whether the early removal of a badly injured eye usually insures the other one against danger of an attack from sympathetic disease. It rarely happens that the second eye becomes affected after enucleation of the injured eye.[1]

If the disease does affect the sound eye shortly after the excision of the injured one, we may feel certain that at the time of the operation the former organ was already beginning to suffer from some very early and easily overlooked symptoms, indicating that migratory disease-bearing elements had already begun to travel from one eye to the other. When, however, the sympathetic disease does not show itself until after a considerable interval the explanation is more difficult.

As is well known, it not infrequently happens that a badly injured eye, after being affected by phthisis bulbi, may remain quiet and free from pain for years; suddenly inflammatory symptoms, more or less severe, set in and the second eye becomes the subject of ophthalmia migratoria. In cases of this sort it is presumed that the causative elements of disease (probably micro-organisms), which have all the time been lying incapsuled (and consequently harmless) within the injured ball have, from some cause or other, been set free. These first produce a new inflammation in the diseased eye, and then wander forth—in all likelihood by way of the lymph channels—towards and finally reach the sound eye, in which they set up sympathetic disease.

One may conclude from this that it is in much the same way that the sound eye is attacked many years after an enucleation of the injured one—the morbific elements had already escaped from the diseased bulb before its removal. The excision does not entirely remove all these germs; some of them are left behind, either in the remaining portion of the nerve or in its neighborhood. The inflammatory reaction following the excision fixes them within the orbit so that they cannot escape. Thus they remain for many years encapsuled and harmless, until something occurs to set them free. Then they resume their unopposed and destructive march towards the healthy eye. There is just one weak point in this analogy, viz.: it seems more plausible to suppose that morbific micro-organisms can remain encapsuled and innocuous for years within a phthisical eyeball than in the loose tissue of the orbit.

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[1] It seldom happens that a prophylactic enucleation gives rise to sympathetic disease in the other eye. Mauthner, *Sympath. Augenleiden*, i., 53.

The first difficulty which the preceding case presents (if we assume that the trouble in the healthy eye is of a sympathetic character) is the tardy appearance of the disease after the enucleation. The second one lies in the local signs. In the majority of instances sympathetic ophthalmia first shows itself as an iritis (or an irido-cyclitis) and finally attacks the whole uveal tract. Less frequently it affects the optic-nerve entrance as a neuritis optica.

If we regard sympathetic ophthalmia as a migratory affection—the morbific elements travelling along the nerve on the diseased side to the chiasma and thence back by way of the other nerve to the sound eye—it is conceivable that the first signs of the disease will manifest themselves at the papilla of the sympathizing eye. In the first part of their journey they will be propagated *in the same direction* as the lymph stream, but in the second stage they must travel *against* the current. There is nothing remarkable about this since micro-organisms in a lymph channel can make progress against the stream.

The above case was one of optic nerve atrophy following a rather marked hyperæmia of the papilla.

Cases of "sympathetic optic atrophy," are described in literature by Mooren, Krenchel, Dransart, and Roosa. Dransart regards the disease as a peculiar form of sympathetic ophthalmia and remarks concerning it that it is often accompanied by other tissue changes, choroidal atrophy, etc., etc.

After experimental demonstrations of the migratory doctrine, says Deutschmann, the older idea (that the papillary decoloration is produced by so-called "sympathetic influences") cannot be entertained.

I do not see anything remarkable in the appearances of choroiditic changes since I had an opportunity, some time ago, of seeing Deutschmann's preparations from the animals he had experimented upon. In the neighborhood of the optic-nerve entrance the changes in the choroid were very noticeable.

The peculiarities of the above case, as well as the difficulties in making a diagnosis, incline me to regard it as a rare form of sympathetic ophthalmia.

The insurance company took my view of the situation and gave the injured man an increased annuity.

I shall briefly relate the remainder of the history. The visual acuity gradually diminished until at present the patient can count fingers only when the hand is held close to the eye. The disk is white, the choroidal changes are about the same as before.

I have but a few additional remarks to make. Although I am an adherent of the migration theory, yet I cannot quite agree with the assertion that the optic nerve furnishes the only route over which the morbid elements can travel to reach the sympathizing eye. If this were true it would seem remarkable that in the majority of instances the earliest and most pronounced evidences of the disease should first appear in the anterior and not in the posterior segment of the eye. The statement that the germs commonly enter the second eye at the disk (where they give rise to little or no disturbance), push their way from behind forward (without producing any decided inflammatory changes in their course), and having finally reached the anterior portion of the globe, there for the first time make their destructive influences felt—all this has something problematical about it. As regards the cases of sympathetic neuritis it is next in order to locate the route along which the infection is carried to the optic nerve. Experiments on animals have demonstrated that it can be transmitted in this manner. When the parts in the anterior segment of the eye are much inflamed, it is difficult, during life, to determine in what percentage of cases the optic-nerve entrance and its vicinity are affected, for even if the ophthalmoscopic examination show a reddened and ill-defined papilla, the latter appearance may be simply an effect produced by hazy media and not pathological changes present in the optic disk.

CASE 2.—The history of the second case will be given only in abstract. J. S., æt. forty-five, was struck in the right eye with a fragment of steel, which entered through the lid into the posterior segment of the ball, causing reduction of vision to mere perception of light. Several months after, the vision of the other eye began to fail. The ophthalmic picture, at first slight congestion and œdema of the retina, developed later into the regular picture of Bright's retinitis. Albuminuria was at first scant and intermittent, later well marked.

A CONVENIENT ARRANGEMENT FOR THE TEMPORARY USE OF PRISMS.

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THE prescribing of prisms experimentally for patients is practised frequently by many oculists at the present time, and as many practitioners prefer to furnish these prisms temporarily, one is obliged to provide oneself with a large number of pairs of prisms with the apices set in various directions to meet the demand in all cases. The following arrangement of prisms has been used by me for some time with so much satisfaction, that I trust it may be of value to others to provide themselves with similar sets. The arrangement consists simply of mounting prisms of the same size and shape as the lenses furnished in a Nachet case, in deeply grooved circular frames, and having the screws that retain the lenses a little longer than usual—a thumb-screw is most convenient; by loosening the screw slightly the prisms can be revolved to any required angle. The prisms are marked with a slight scratch showing the direction of the apex, and the frames can be made with various styles of nose-rests, and interpupillary dimensions, and with straight or riding bows. These mounted prisms have been made for me by Queen & Co., Philadelphia.

A REMARKABLE CASE OF COMPLETE PARALYSIS OF THE INTERNUS AND EXTERNUS OF EACH EYE.

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ALTHOUGH in ocular paralysis we are accustomed to meet with all sorts of wonderful combinations of paralysed muscles, the simultaneous paralysis of both interni and externi is certainly a combination we do not often observe. But the following case is still more interesting by its remarkable course and its speedy and complete recovery.

On May 3d Mr. G. F., a German druggist, twenty-two years of age, consulted me in regard to his eye trouble. He has always enjoyed good health except two years ago when he had pneumonia, and five years ago when he was overcome by heat and seriously ill for two weeks; but he recovered completely, and had not felt the slightest after-effect from this heat-stroke all these five years. His habits are regular and temperate; and he is very emphatic in denying the possibility of syphilis, and I have no reason to disbelieve his word.

Now two months ago, while engaged in compounding some medicine, he suddenly experienced a peculiar difficulty in seeing; he found he was obliged to turn his head instead of his eyes if he wished to look from one object before him to another. This visual embarrassment has continued ever since; it is no worse nor any better either; it makes him dizzy in walking, and is attended by a continuous dull headache.

When the patient entered the room my attention was at once attracted by a strange, staring expression of his eyes, which the examination showed was caused by the patient's inability to turn either eye to the right or to the left. The left eye stood exactly in median position; the right eye showed a convergence of ten degrees (by the perimeter), but in neither eye the faintest trace of any lateral movement (adduction or abduction) could be observed when the object was carried from the median position to the right or left. When the object was carried upwards or downwards the eyes readily moved up and down, but their movements were strictly limited to the perpendicular line, no adducting or abducting deflexion being possible. Each eye showed normal vision, emmetropic refraction, and read Jäg. 1 up to five inches; the pupil responded readily to light, and the fundus showed a normal ophthalmoscopic appearance. The diplopia test had a very singular result: in the median line and in left side of the common field of vision, the patient saw two (homonymous) images; but as soon as the light crossed the median line toward the right the diplopia ceased, and the patient saw one light only in the whole right visual field.

On the 10th of May I exhibited the case before the Ophthalmological Society. The paralysis of both interni and externi was still complete; but there was also a complete paralysis of the right side of the face. The members present also convinced themselves by repeated tests of the absence of double images in the right field, and were inclined to give a rather unfavorable prognosis.

The next day I received a telephone message that Mr. F. was too ill to go out, and then I heard nothing of him until June 17th, when he walked into the office a perfectly well man; no trace of facial paralysis, and perfect adductive and abductive movements of each eye; only the right eye still showed a convergence of 10°. An examination made November 30th showed that this convergence of the right eye had disappeared, and binocular fixation was fully re-established. The perimeter showed the rotation of each eye outwards 65°, and inwards 50°.

As to what happened between May 10th and June 17th, Mr. F. gave the following information: While he was under my observation he had been taking iodide of potassium at the suggestion of another physician, and though it did not agree with him at all (causing dyspepsia and nausea) he persisted in increasing the doses until he took twenty-seven grains three times daily. That was on the day when he appeared before the Ophthalmological Society; and the next morning he awoke with vomiting blood and all symptoms of a violent gastritis, which his physician at once pronounced as being caused by the excessive use of iodine. He was confined to bed for one week, and during this time the left side of his face also became paralyzed; both arms were paralyzed, and even the legs were affected so much that he was unable to walk alone. After two weeks, when he had recovered from the iodine, he began taking strychnine (gr. $\frac{1}{60}$), and within one week he thought he could notice an improvement. He first recovered the use of his legs and arms, then the facial paralysis disappeared, and finally the eyes recovered their lateral mobility.

A NEW PERIMETER.

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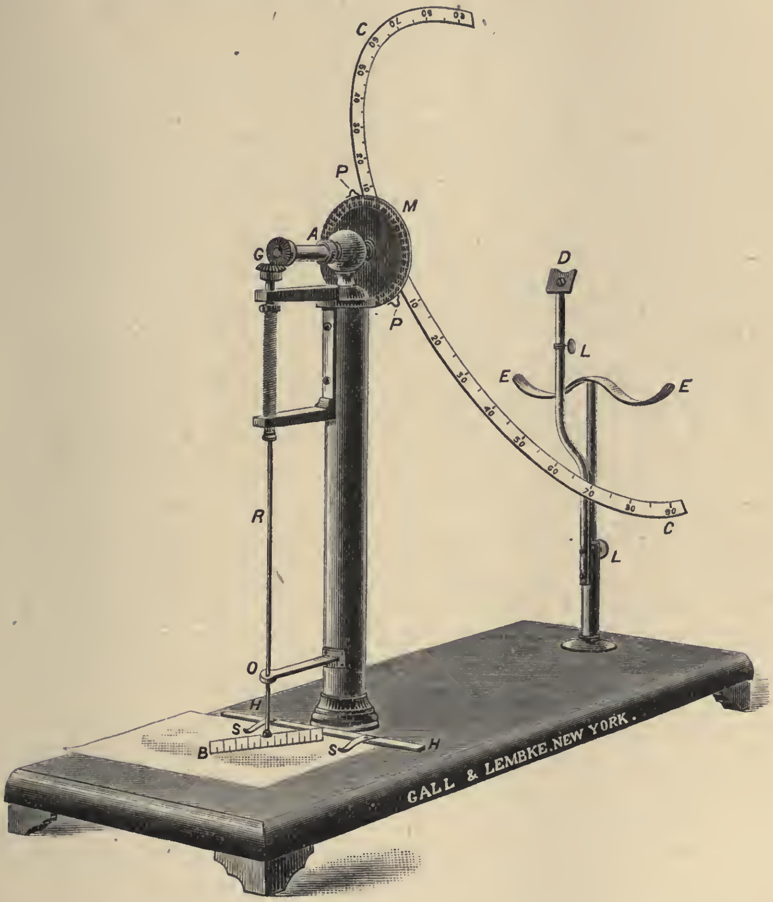
(*With a wood-engraving.*)

THE perimeter illustrated by the accompanying engraving differs from others in use, chiefly in the device for recording observations, which is seen at the left of the engraving. This device consists of a graduated index-bar *B* fixed at the lower end of a vertical rod *R*, which is connected with the axis *A* of the instrument by means of a bevelled gearing *G* in such a way that every change in the position of the graduated arc *C* is indicated by a corresponding change in the position of the index-bar.

The instrument is designed to be used with Emerson's perimeter charts, but any other chart may be used, or if no chart is at hand, a blank sheet of paper will serve the purpose, because the angle of the graduated arc is always shown by the position of the index-bar, and it is only necessary to mark with a pencil by the side of the index-bar at the degree corresponding with the observed point upon the graduated arc.

If the Emerson chart is used, the chart is to be placed under the index-bar with the base toward the patient and against the brass guide *H*. There it is held by means of the spring clips *S*. In this position every portion of the field as represented upon the chart will be opposite the corresponding portion of the field of the eye under observation, and consequently there will be no danger of recording an observation upon the wrong side of the chart and thereby reversing the field.

The axis *A* is hollow, so that, if desired, the observer may keep watch of the patient's eye through the opening. At the axis is a graduated circle *M*, the position of which is



fixed, while around it revolve two pointers *P* which are fixed to the arms of the arc.

The readings shown on the graduated circle should correspond exactly with those shown upon the chart by the index-bar. By means of this additional index, the observations, as taken upon the chart, may be verified, and if by accident the index-bar is moved from its proper position, the true position may always be found by a comparison of the two scales. If the recording apparatus should be broken by any accident, the degrees could be read upon the graduated circle and noted upon the chart in precisely the same way as with perimeters of the ordinary form which are not provided with a recording apparatus.

The other parts of the instrument are easily understood from the engraving. It will be noticed that both the chin-rest *E* and the guide for the position of the eye *D* are adjustable, and are held in any desired position by means of the thumb-screws *L*. It can easily be seen by looking through the hollow axis *A*, whether the patient's eye is properly centred, because the axis is of such a length that the least deviation from the centre may be noticed.

The engraving was kindly furnished for the purpose of illustration by the makers of the instrument, Messrs. Gall and Lembke, 21 Union Square, New York.

A CASE OF HEMORRHAGIC IRITIS, WITH REMARKS.

By Dr. CHARLES ZIMMERMANN, Milwaukee, Wis.

BEFORE entering into a discussion on the subject I shall give the clinical history of the following case:

A. B., a dredging contractor, aged thirty-three, of healthy appearance, had no constitutional disease, especially no lues nor tuberculosis. His parents are living and healthy. *Nov.* 3, 1888, he came to my office with a recent *iritis* of his *right* eye. Iris discolored, reacting sluggishly to light. A few synechiæ were torn by atropine. He was in bed until *Nov.* 8*th*, when he got up and went into another room of a cooler temperature. But he could not stay up long, on account of cilliary pain setting in soon after this change. In the evening I found the pupil dull and grayish from a very *copious fibrinous effusion into the anterior chamber*. The pupil was round but less dilated. No red reflex upon inspection with the ophthalmoscope. The next morning the exudation had become denser, so that he could not count fingers near by. Inunctions of mercurial ointment were ordered, which favored the absorption strikingly. *Nov.* 10*th*, the effusion was thinner, so that he could count fingers at three feet; *Nov.* 11*th*, a cloudy red reflex could be obtained for the first time on ophthalmoscopic examination; *Nov.* 15*th*, the pupil was free from any deposit; V = fingers in ten feet; he could distinguish the hands of the watch; details of fundus could be seen indistinctly. *Nov.* 19*th*, he left the bed, and *Dec.* 1*st*, the house. *Dec.* 4*th*, $V = \frac{15}{15}$. *The eye recovered perfectly.*

In *January*, 1890, he had a slight *relapse* of *iritis* in the *same eye.* The blue iris discolored to green and ciliary injection, no synechiæ. He was at once put to bed and treated with atropine and diaphoretics, so that he *recovered in a week.*

April 20, 1892, he came again with slight pericorneal injection of the *same (right) eye.* The pupil reacted promptly to light, and as the iris showed no inflammatory symptoms, I attributed the cause of redness to some dust in his conjunctival sac, which I removed, and gave him cocaine as an antiphlogistic. *April 21st*, status idem. In the evening he went to a wedding party and danced considerably until the early morning. The consequence was a pronounced *iritis of the right eye.* An adhesion at the upper periphery became apparent after dilatation of the pupil by atropine. In the afternoon it was torn, iris green; the whole front of the eye intensely red; no pain. *April 24th*, put to bed, as a *gray exudation in the pupillary area* had formed. *April 25th*, the effusion being larger and chemosis having set in, six leeches were applied to the temple at 6 P.M.

April 26th: more than the lower two-thirds of the anterior chamber were filled with dark coagulated blood.

Only the upper portion of iris was visible. It showed intense swelling, was very much congested, and looked dull from fibrinous effusion into its structure. I ordered inunctions of mercurial ointment and diaphoretics. *April 27th*, the amount of blood had somewhat diminished. Pupil still covered by fibrinous deposits, which had also become less, so that the upper periphery of the pupil gave a red reflex upon ophthalmoscopic examination. $V = 0$. *April 28th*, he took salicylate of soda 5,00, every hour 1,00, with remarkably good result. *April 29th*, the largest portion of the pupil was free, and on *May 3d*, after repeated doses of salicylate of soda, there was no longer any trace of blood or fibrine in the anterior chamber.

He recovered very nicely. June 1st, V in that eye was $\frac{15}{10}$. During this last attack and even after convalescence, until July, he felt some pain in the muscles of his left upper arm, which appeared to be rheumatic. The patient is very much exposed to the injurious action of dampness, wind, and cold, being engaged in dredging rivers and lakes and building foundations in swamps, which may account for the frequent relapses of iritis.

The most striking feature in this case is the association of iritis with hyphæma, i. e., its hemorrhagic character.—The occurrence of hemorrhages during the course of iritis is regarded as extremely rare, "exceptional" according to Wecker,[1] and, as far as I was able to peruse the incident literature, only a few publications exist on it by Hutchinson,[2] Keyser,[3] Reche.[4] In order to find an explanation for this complication, it be may well to consider *what part the blood plays in iritis.*

1. One of the first and usual signs of iritis is *hyperæmia.* Not only are the extremely numerous blood-vessels of the iris, which form the most prominent streaks of its surface, extended and injected so that they appear as red loops and nodules, but even a number of smaller vessels, not visible before, become quite pronounced now by their engorged condition. Wecker (*l. c.*) believes in a new formation of blood-vessels on the surface of the iris, and thinks that the so-called ecchymoses of the iris, if carefully examined through a magnifying glass, may be found to be mostly convolutions of small blood-vessels.

2. If we go a step further, some of the *coloring matter* of the *blood* will *transude* through the walls of the blood-vessels of the iris, which are pretty thick on account of their well-developed muscular structure, imparting a different tint to the natural color of the iris by *infiltration of its stroma with hæmoglobine.*

3. A higher degree of inflammatory reaction will be indicated, if the *walls of the blood-vessels* undergo such a change, that they *become permeable for* the *red-blood corpuscles,* which pass them and enter the tissue of the iris. Then we have extravasations of blood into the substance of the iris. Larger hemorrhages especially happen between the posterior limiting membrane and the pigment layer.[5] The swelling and infiltration of the structure of the iris are partly due to them. On the surface of the iris we see such hemorrhages in gummatous or condylomatous iritis, in which the yellow nodules are sometimes streaked with blood.[6]

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[1] Graefe-Saemisch, iv., p. 492.

[2] *Ophth. Hosp. Rep.*, 1874, viii., p.3, and *Nagel's Jahresbericht*, v., p. 327.

[3] *Philad. Med.* and *Surg. Rep.*, 1874, p. 211, and *Nagel's Jahresber.*,v., 323.

[4] *Klin. Monatsbl. f. Aughenh.*, 1892, May, p. 176.

[5] Michel, *Lehrbuch der Augenh.*, ii. Aufl. p. 313.

[6] Noyes, text-book on *Diseases of the Eye,* 1890, p. 408.

4. There will be severer varieties of iritis, in which the *red blood corpuscles* not only penetrate through the walls of the vessels, but even through the tissue of the iris and *form a part of the effusion into the aqueous humor.* In fibrinoplastic iritis, *e. g.* the coagulating matter of the aqueous is increased partly by the presence of lymphoid and pus cells and red blood corpuscles, causing the turbidity of the aqueous. Red blood corpuscles are also found in the fibrino-purulent forms of iritis and very often in the accompanying hypopyon, which shows sometimes streaks of blood; or its color becomes changed at the bottom from an accumulation of red blood corpuscles. This is even more marked in *spongy iritis* (Knapp), according to the examinations of Arlt, who "described the exudation as sero-fibrinous and hemorrhagic, in which the fluid and cell elements tend to separate."[1]

5. The most pronounced appearance of blood, of course, occurs when the *red blood corpuscles* escape in such masses as to *fill the anterior chamber* partly or wholly and form a *regular hyphæma.* Most authors saw this in purulent iritis. Hyphæma alone (without hypopyon) as a complication of iritis is mentioned as a rare phenomenon by Klein,[2] Vossius,[3] Keyser,[4] and Reche.[5] Hutchinson[6] noticed hemorrhagic iritis, (1) after operations; (2) in sympathetic iritis, in which hyphæma is a very unfavorable symptom; (3) in chronic iritis of old people; (4) in certain arthritic individuals.

If we ask for the *causes* of the *spontaneous hemorrhages of the iris* in general (not considering the traumatic), we may look for them under two different headings:

1. *Hemorrhages,* dependent upon *diseases of the blood-vessels,* as atheroma or fatty degeneration. The latter condition very likely prevails, when violent efforts in spells of vomiting, coughing, sneezing, or during labor, in pulmonary emphysema, or heart diseases lead to hemorrhages into the anterior chamber (the increased pressure of expiration augmenting the tension in the veins and capillaries and

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[1] Noyes, *l. c.*

[2] Klein, *Eulenburg's Real-Encycl.*, Aufl. ii., vol. viii., p. 624.

[3] Vossius, *Grundriss der Augenh.*, 1888, p. 200.

[4] Keyser, *l. c.*

[5] Reche, *l. c.*

[6] Hutchinson, *l. c.*

causing ruptures of their walls). The hemorrhages observed in vascular or teleangiectatic[1] growths,[2] *e.g.* in granulomata, in gummata, or condylomata, are a consequence of the degeneration of the wall of the vessels enclosed in the neoplasma. Some general affections leading to hemorrhages anywhere in the body may cause hyphæma, *e. g.* scurvy,[3] pernicious anæmia, anæmia from great losses of blood.

2. *Hemorrhages from sudden changes of the intraocular pressure.*[4] In plastic irido-choroiditis with complete occlusion of the pupil, the increased tension may suddenly fall to a minus condition and give rise to an extravasation of blood into the anterior chamber. The same is known of eyes which have become phthisical in consequence of cyclitis. Wecker (*l. c.*) saw hyphæma in cases of absolute glaucoma or in earlier stages of glaucoma, if its hemorrhagic character was indicated by multiple retinal hemorrhages, or in the glaucomatous period of intraocular tumors. The sudden decrease of intraocular pressure during the performance of iridectomy in glaucoma produces sometimes copious hemorrhages from the iris.

In our case I noticed the hyphæma at 8 A.M., at the first visit after the leeches were applied (at 6 P.M. on the previous day), *i. e.*, after about fourteen hours, no observation being made in the meantime, so that it may have occurred sooner. In that event we might assume that the intraocular pressure, which is often augmented in iritis,[5] suffered an instantaneous diminution by the depletory effect of the leeches and gave rise to the bleeding.

According to Arlt,[6] "a collection of blood in the anterior chamber may in many cases be referred to *inflammatory changes in the ciliary body* and thereby impeded reflux of blood to the venæ vorticosæ." This however was not here the case, as the chief diagnostic symptoms of cyclitis were wanting. There were no pathological changes of the deeper uveal structures, no manifest deviation from normal tension, and especially no pain or even tenderness on gentle pressure on the upper portion of the ciliary region.

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[1] Schelske, *Lehrb. d. Aug.*, 1870, pp. 72–97, and *Nagel's Jahresber.*, i., p. 298.

[2] Knapp, intraocular tumors.

[3] Michel, *l. c.*, p. 319.

[4] Wecker, *l. c.*, p. 573.

[5] Schweigger, these ARCHIVES, xx., p. 477.

[6] Arlt, *Clinical Studies on Diseases of the Eye*, translated by L. Ware, 1885, p. 279.

In the three cases of Reche (*l. c.*) a *rheumatic disposition* existed, which he considered as the *etiological element* of the *hemorrhagic iritis*, but in what manner he does not say. On the other hand Noyes[1] asserts that "rheumatic and gouty iritis are more *serous*." But as it is claimed that the gouty or rheumatic, or syphilitic dyscrasia are frequent factors in retinal hemorrhages from a weakened condition of the vessels,[2] they might also lead to hemorrhages of the iris, in spite of the thicker walls of its vessels in comparison to those of the retina. And indeed Hutchinson (*l. c.*) saw in certain arthritic individuals each attack of iritis commence with a hemorrhage into the anterior chamber.

This, however, does not apply to our patient, who, being otherwise perfectly healthy cannot be said to have suffered from any dyscrasia, even if he had some rheumatic pain in his arm.

The iritis itself being very violent, since it attained such a high degree in a very short time, it seems to me that its *hemorrhagic character* was not dependent upon any special etiological type, but that it was simply a *sign of its intensity* from the following reason: The red blood corpuscles permeate the walls of the capillary vessels by diapedesis, and will be the more numerous the more the capillary network of an organ is developed. *An effusion becomes chiefly hemorrhagic if the walls of the capillary vessels are very much changed by the inflammation; and consequently their circulation is considerably impeded, as it happens in* VERY SEVERE INFLAMMATIONS.[3]

This general law gives the most satisfactory explanation of our case, which shows, that *iritis of very intense character may now and then be complicated by hemorrhages.*

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[1] *L. c.*, p. 410.

[2] *Ibid.*, p. 553.

[3] Cohnheim, *Vorlesungen über allgemeine Pathologie*, i., p. 217.

HISTORY AND PRINCIPLES OF KERATOMETRY; ITS VALUE AND LIMITATION IN THE CORRECTION OF ASTIGMATISM.

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(*With five drawings.*)

THOMAS YOUNG, the celebrated natural philosopher, was the first who in 1793 discovered the astigmatism of the dioptric system of the human eye. He observed it in his own person, where it amounted to about 1.5 D, and concluded from different experiments that it had its cause in an oblique position of the crystalline lens. The second known case of astigmatism is that of the English astronomer Airy, who in 1827 described his own case, but, in the absence of any satisfactory reasons, wisely refrained from expressing any opinion as to the seat of his defect; nor does it seem that he tried any experiments to elucidate that point. Other cases were reported by Dr. Goode in 1848. Here the lens was suspected, for he states expressly that, in a case of high astigmatism, he in vain endeavored to find by the form of a reflected image any peculiar asymmetry of the cornea and that he therefore was inclined to look for the source of the trouble in the crystalline lens. The first, however, who found the cause of the astigmatism in the cornea, was Dr. Thompson at about the same time, though it is not said by what method the result was obtained. Later, in 1855, Wharton Jones and Wilde simply assert that the cornea in its vertical meridian has a shorter radius of curvature than in the horizontal one. But they did never observe it themselves, and, as up to their time no exact measurements of the cornea had been performed, except one, it seems rather probable that these authors simply ventured upon that assertion without a scientific basis for it. They hardly deserve credit therefore for that statement; but they may serve, as Donders sarcastically remarks, to show that sometimes even in science we may observe the truth of the old words: *Audaces fortuna juvat.*

It was only after exact measurements of the cornea had been made, that the question about the action of the cornea in astigmatism could be settled. And it was not long till they were made. It is true that already more than one hundred years before, in 1723, the Frenchman Petit determined the curvature of the cornea in dead animals by cutting segments of different circles into pieces of copper, and then trying which of these segments exactly fitted the cornea; by which means he obtained pretty accurate results, and first observed the flattening of the cornea near the limbus. Thomas Young also, in 1801, had determined in a very ingenious way the curvature of his own corneæ, and in 1832 by C. Krause and later, in 1847, by C. Brücke elaborate measurements of the cornea had been made, but simply by compasses and finely divided rulers. But these were all not exact enough for the purposes of physiological optics, where accuracy down to $\frac{1}{100}$ of a millimetre is demanded. A better principle had to be applied, and that was found in the study of the images of objects reflected from the cornea. For the anterior surface of the cornea is a little convex mirror, and the known laws of catoptrics allow us to find the radius (r) of a spherical, convex-reflecting surface if the size of the object (O), the size of the image of this object on the mirror (cornea) (I), and the distance of the object from the mirror (cornea) (d) are known. These four quantities are in the following relation $\frac{\text{Object}}{\text{Image}} = \frac{O}{I} = \frac{2d + r}{r}$, from which is found $r = \frac{2dI}{O-I}$.

Now in this expression for r, the quantities d and O can be easily and accurately measured, and all that remains still to be put into this formula is the value for I, the size of the corneal image. If this could also be easily measured, r could be found quickly by a simple calculation. *The whole* *problem, therefore, reduces itself to the measurement of this small corneal image.* This problem is the same as that of measuring the size of small heavenly bodies, or the angular distance between two stars in astronomy; so that almost the same instruments might be used, if only the astronomical telescope of long focus be changed into one of short focus. And, indeed, the science of measuring this small image on the cornea, *keratometry*, has passed through similar phases as micrometry in astronomy. The first instrument used in astronomy was a filar micrometer, in which two fine threads of a spider's web are movably so arranged that each can be made to coincide with one end of the small object. From the observed distance between these two threads, then, the size of the observed object, or the angular distance between two stars, is easily calculated. And this principle was first employed for the cornea by R. H. Kohlrausch, in 1840, and Senff, in 1846, the latter of whom even succeeded in measuring the horizontal and vertical radius of curvature of the cornea, and so finding the ellipticity of its form. But this method is not a good one for the human cornea, for the reason that while the heavenly bodies are quiet and do not oscillate during the observation, the eye almost constantly performs little jerky movements, so that it is very hard, if not impossible, to make the two threads coincide with the two end-points of the image at the same time; as any one, who has a microscope, can form a good idea of, if he will simply try to measure a small moving body on the stage with an eye-piece micrometer.

This method, therefore, was given up soon and another employed, long before used in astronomy, and first introduced into that science by Savary in 1743. It consists in doubling the little object looked at, and bringing these two objects in such a relation to each other that they are just in contact. Suppose that the object looked at was

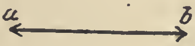

Fig. 1

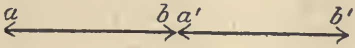

Fig. 2

ab (Fig. 1), and that we had some means by which we could not only leave *ab* there, but at the same time displace each point of it a certain distance. Then we would get two objects, and if we made the displacement of each point equal to *ab*, it is evident that a^1, the displaced *a*, would fall upon or just touch *b*, and that we would get a configuration like Fig. 2. We observe now that, if the two images touch each other, the displacement of each point must be equal to the size of the primary image, and that we shall know the size of this image, if we can find the displacement of two homonymous points when there is contact between the two images. We measure, then, the size of the corneal image by the displacement that must be given to each point, in order to produce contact between the two images. This principle is a great improvement, because if now the observed eye moves a little, both images move in the same way, so that it is still very easy to produce contact.

Savary's method, as modified by Dollond in 1754, and still almost exclusively used in astronomy, consists in cutting through an achromatic objective directly through its optical centre, and then framing these two halves so that they can be slided upon each other, thereby producing at the same time the effect of a prism and of two equal lenses, each of which gives rise to one image. The size of the observed object (I), or in our case, the dimension of the corneal image (I), the focal distance of the objective used (f), the distance of the corneal image from this objective (d), and the displacement between the two centres of the semi-lenses (e), necessary to produce contact between the two images, are in the following relation to each other: $I = \frac{e\,d}{f}$.

Now as d, the distance of I from the objective, and f, the focal distance of this objective, can be readily determined, it is only necessary to find e in order to obtain I. If we therefore measure the value of e by a fine screw, as is done in astronomy, we have all the data for calculating I. But, as the determination of e requires a very costly mechanical arrangement, it is more convenient for our purpose to once for all fix e, the intercentric distance, so that together with given values of d and f, a certain value of I, say 3 *mm*, is produced. And if further we made $d = 2f$, that is, twice the focal distance of the objective, then we would have $I = \frac{e\,2f}{f} = 2e$. Now it is well known that if an object, here the corneal image, is at $2f$ from the objective, then the image of this by the lens will appear at $2f$ behind the lens and be of exactly the same size as the real corneal image, a fact also employed in Javal's instrument. If, therefore, the corneal image is 3 *mm*, we have to make $e = 1.5$ *mm;* then there will appear at $2f$, behind the lens, 2 corneal images, each of the same size as that on the cornea = 3 *mm*, and therefore just touching each other, provided the cornea is $2f$ *mm* from the objective. Now in our formula for $r = \frac{2dI}{O-I}$ the values for d and I are constants by our arrangement, and we only have to observe for each case the value of O, or the size of the object necessary to produce at $2f$ from the cornea a corneal image $= I = 3$ *mm*. This can be easily done by moving one end-point of O till the two corneal images are just in contact, as will be described more in detail later on. An instrument of this description for keratometry was proposed by Tscherning in 1887, and I know by actual experiment that it can be easily constructed. If we took *e. g.* an achromatic lens of + 4. *D*, the distance between the centres of the two halves would have to be 1.5 *mm* in order to produce from a corneal image of 3 *mm* at the distance of 500 *mm* from the eye, two corneal images exactly in contact and each equal = 3 *mm*, at 500 *mm* behind the objective, where it could be conveniently enlarged by an eye-piece.

This modification of an old astronomical method, though it seems so natural to think of it, was not made use of then in the history of keratometry. It was another later device, also by an astronomer, that gave in a great man's mind the impulse to the first celebrated ophthalmometer. In 1841 the astronomer Clausen first proposed to use two plane glass-plates in order to get the double images of the stars. One of his plates was stationary, while the other was movable; so that the rays of light from an object in the axis of the telescope would fall perpendicularly upon one plate, but obliquely upon the other. Now it is a fact that, if we look through a plate of glass of the thickness δ at an object lying in a line at right angles to the plate, we see the object in its old place, but we see it displaced laterally as soon as the plate is turned by an angle α, which displacement is $= \frac{\delta \sin(\alpha - \beta)}{\cos \beta}$ where δ is the thickness of the glass, α the angle of rotation of the plate, and β is an angle found by the well known law, $\sin \alpha = n \sin \beta$, if n is the index of refraction of the glass used. This device was perfected by Helmholtz. He made both plates rotate equally, and putting them in a box in front of a telescope for short distances, he so constructed his ophthalmometer, with which up to about a decade ago all the important work in physiological dioptrics has been done. In the instrument as made by Meyerstein in Göttingen, and which was used by the author for some time,[1] there was $\delta = 4.3972$ *mm*, and $n = 1.518$, so that for a corneal image of 2 *mm* the rotation of each plate had to be 33° 42′. For a corneal image of 2.1008 *mm* α was = 34° 57′, which shows how sensitive the instrument is, especially as it allows to read off the tenths of a degree.

After Helmholtz in 1854 had published his method and results about the exact form of the cornea, he was soon followed by men like H. Knapp, F. C. Donders, and others. By their labors the physiological and pathological shape of the cornea in all meridians was investigated, so that very little was left to be added to their work. They found first that the cornea is the main but not the only seat of the astigmatism. But to that question we shall return later on. First we must add a few more remarks to our historical sketch. The instrument of Helmholtz is used in such a manner that the object reflected from the cornea remains unchanged. Here the object is the imaginary line between two points of light, *a* and *b*.[2] These are reflected from the cornea, and if the second image of a, that is a^1, does not fall on b, the glass-plates are turned till they do so. Then the displacement equals the size of the corneal image $ab = \frac{2\delta \sin(\alpha - \beta)}{\cos \beta}$ where δ α, and β have the meaning before mentioned. Middelburg added to the armamentarium a large copper ring, also used by Donders, on which he moved the line of his lights by the same angle as the box of the ophthalmometer, so that in that way he was able to measure the radius of curvature of the cornea in all possible meridians.

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[1] The privilege of its use for some months was kindly granted to me by its owner, Dr. Geo. Strawbridge of Philadelphia, to whom I express herewith my sincere thanks.

[2] I know very well that not two, but three lights or mirrors are used, but as the principle involved is the same as with two, the simpler arrangement is chosen for the description of the principle.

Although this instrument of Helmholtz has done so much for scientific research, it has some disadvantages which do not allow of its being used very well outside of a laboratory. The instrument must be off from the observed eye at least six feet, the box with the glass-plates must be turned separately from the lights around the axis of the telescope, and, what is the greatest objection to its clinical use, for the determination of each radius not less than eight careful readings of a fine nonius have to be made, *while not less than sixteen readings are required for finding the corneal astigmation.* It takes therefore a great deal of time and labor and so has never come into general use. Something simpler was wanted for clinical purposes. Here the first thing naturally was to simplify Helmholtz's instrument, and this was first done by Javal and Schiötz in 1880, who, however, afterwards left this principle for another one. Another modification that is used by the author, is the modification by Leroy and Dubois. It has the two glass-plates, fixed at a certain angle to each other, thereby producing a certain fixed displacement of about 3 *mm.* The contact of the double images is regulated by sliding on a graduated *straight* bar a reflector, which forms one end of the imaginary line, the object, while the other end is represented by a stationary reflector. In its present condition the instrument requires careful manipulation and a very good light to give accurate results, but, with some improvements and the addition of a headrest, may well compete with Javal's, especially as it can be made at less cost, but it must be admitted that for the determination of the meridian it is inferior to Javal's.

However, it was not this principle which was simplified first, but an entirely different one. Coccius was it, who, in 1867, first employed that new principle of producing the double images. This principle had also been employed before in astronomy, having been invented and first applied there by Rochon, in 1801. In this method a prism or rather two prisms of quartz, a double-refracting substance, are used, which, by arranging all the rays from an object into two differently refracted sets, an ordinary and an extraordinary one, make thus the object appear double.[1] The amount of displacement it produces depends with a given prism on its position in the telescope, and for that reason it is given a fixed position in the tube in such a manner that, under the conditions used, a certain displacement, say 3 *mm*, is obtained. Then we have in our formula for $r = \frac{2dI}{O-I}$, the values d and I always the same, and we have to arrange the object so that the two images of it on the cornea are exactly in contact. This is, in the main, the principle of the latest instrument, that at present plays such an important part in the discussions of the ophthalmological societies.[2] Javal's ophthalmometer indeed is at the present time the best instrument that we possess to quickly determine the form of the cornea, and it ought to be used more extensively by the profession. It consists in the main of a double-refracting prism, which is placed in a telescope so, that at twice the focal distance of the objective used, which distance is marked in the tube by two fine, crossed threads, there appear of each point on the cornea two points, 3 *mm* apart. Should, therefore, the little image on the cornea be 3 *mm* long, then the double images will just touch each other. Javal uses as his object an imaginary line, the distance between the inner edges of two white reflectors A and B; one of which A is a full rectangular figure, while the other B is divided into steps. These reflectors slide on an arc[1], that is so fixed to the tube of the telescope that it can be only rotated together with the tube and the prism around the axis of the instrument. Suppose, for example, that the two reflectors have been so arranged that A^1 and B just touch as Figure 3 shows.

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[1] Different authors, among them even Noyes, speak of this prism as a Nichol's prism. This is a mistake, as a Nichol's prism never produces double images of an object, but is rather used to suppress one, the ordinary one.

[2] There have been several attempts to replace the glass-plates and double-refracting prisms by two simple prisms of crown glass, *e.g.*, one by Landolt, in 1878, who so constructed his diplomètre. Besides Schöler and Mandelstamm (1872) invented their micro-optometer and Donders (1872) his corneal microscope for ophthalmometric measurements. But these attempts have not been very successful. One new method, however, has been employed by Blix, of Sweden, in 1880, by which he can measure the radius of curvature at one point of the reflecting surface (*Oftalmometriska Studier*, Upsala, 1880). But space forbids a description of this ingenious plan.

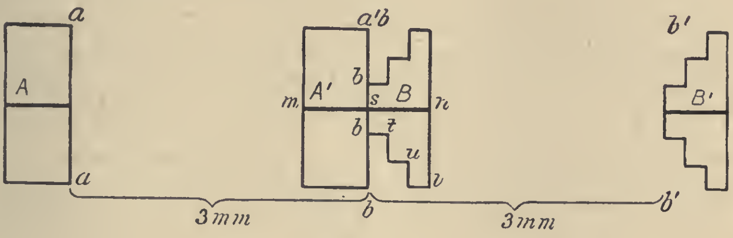

Fig. 3

Here A and A^1 are the double images of one reflector, and B and B^1 those of the graded one. The distances $a\ a^1$, and $b\ b^1$ are each $= 3$ *mm*; they represent the displacement of homonymous points, while ab is the corneal image to be measured and which here is $= a\ a^1 = 3$ *mm*. We also see here that the two black lines on reflector A^1 and B are in one straight line (*msn*), which position must be always sought for, as it indicates that we are in a main meridian. Let us now turn our instrument around its axis, till we again come to a position where the two black lines *ms* and *sn* are in one straight line *mn*; then if the radius of curvature is the same here, we will, of course, see also no change here in our corneal double images; but if the radius be smaller, we will observe that B partially overlaps A^1. This must be so, for as $r = \frac{2\ d\ I}{O-I}$ we must, d and O having remained the same, get a smaller I for a smaller r. Therefore, our corneal image of O must become smaller than before, smaller than ab; while $a\ a^1$

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[1] This ought to be a straight line, because on an arc the distance d of object and cornea in continually changing, just as the distance of a chord from the centre of a circle is changing as long as the chord changes.

and $b\ b^1$, the displacements of homonymous points, remain still the same by virtue of the prism. If then the distance between A and A^1 and that of B and B^1 remain the same, while the distance between A and B gets less, it is evident that B must fall on A^1; partially or wholly, that depending on the smallness of the new corneal image. Suppose, then, that now B overlapped A^1 as far as u or two steps, we would then know at once that the new O, call it O^1, would have to be two steps larger in order to have a corneal image $= a\,a^1$ or 3 *mm*, as before in the first meridian. Now the question arises, how much larger do we have to make our object, or how large our steps, that each shall indicate just one dioptry increase of refractive power or corneal astigmatism. To answer this we must remember that the *posterior* focal distance of the cornea is $F_1 = \frac{rn}{n-1}$ if r is the radius of curvature, and $n = 1.3365$, the refractive index of cornea and aqueous humor. Now we always express the refractive power by dividing 1000 by the focal distance, the latter expressed in *mm*. We must divide 1000 by the *posterior* focal distance, as only the *posterior* focal distance of the cornea is an indicator for the refractive power of the cornea for rays that come from the outer world. It is therefore a mistake if Javal takes the anterior focal distance which is $\frac{r}{n-1}$. But more of that later on. We have, then, for the refractive power of the cornea D the value $\frac{1000}{F_1}$, so that we get $D = \frac{1000}{F_1} = \frac{1000\,(n-1)}{rn}$ and if we substitute the value for $r = \frac{2dI}{O-I}$ we have $D = \frac{1000\,(n-1)\,(O-I)}{2dnI}$. Now suppose that in another meridian of smaller r we have to make $O = O^1$ in order to get contact, or at least to get a corneal image of the same size as before, then we have here $D^1 = \frac{1000\,(n-1)\,(O^1-I)}{2dnI}$. The difference in refractive power between the two meridians will then be $D^1 - D$, which $= \frac{1000(n-1)(O^1-O)}{2dnI}$. Now in Javal's instrument the distance (d) of the object from the cornea is 281 *mm*, the image I always

$= 3$ *mm*, and as $n = 1.3365$ we have $D^1 - D = \frac{336.5\,(O^1 - O)}{2n\ 281 \times 3}$ $= \frac{O^1 - O}{6.7}$; that is, if $D^1 - D = 1$, then $O^1 - O = 6.7$ *mm*, or we have to make the object 6.7 *mm* larger for each dioptry increase of refractive power. Each step would, therefore, have to be 6.7 *mm* large; but Javal makes his steps only 5 *mm* for each dioptry of astigmatism. What is the cause of that? The cause for this discrepancy lies in the *different meaning of the term corneal astigmatism.* We meant with it so far the difference of the actual refractive powers of two main meridians, $D^1 - D$, *while Javal means by that term the cylinder, which corrects this* $D^1 - D$. This is by no means the same as we shall see in a moment.

To elucidate this point and several others about the correction of the real corneal astigmatism $D^1 - D$ by cylinders, and also to show why Javal makes his steps each $= 5$ *mm*, we put the general question in the following way. If there is given an astigmatic cornea, which has in one main meridian the refractive power D, while in the second main meridian at right angles to the first it has the refractive power of D^1 dioptries, what is the glass that has to be placed at the distance d from the cornea in order to correct the astigmatism? But as generally there will be also axial ametropia, the question must rather be brought into the following form. What are the two cylinders which, at the distance d from the cornea, will bring the rays of distant objects to a focus on the retina in each main meridian? For if we have corrected the two main meridians, our problem is apparently solved. This question, as far as I know, has never been put in this general way before, but it must be done; for it will be shown that the former proposition, simply to find the cylinder that will bring the rays of light through both main meridians to the same focus behind the cornea, after they only passed through cornea and aqueous humor, will not be sufficient, if we put the glass at the distance d from the cornea. In order to prove that, we have to recall for a moment a few formulæ about the dioptrics of the human eye. The accompanying diagram will help us to see the space-relations of the different points.

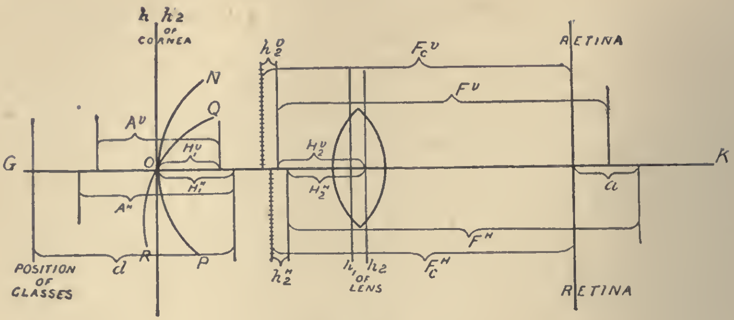

Fig. 4

Here *NOP* is the vertical meridian, or that of smallest *r*. *QOR* is the horizontal meridian, or that of greatest *r*. The retina and lens will be recognized at once, though the lens has been removed too far from the cornea for the sake of clearness. All the points, lines, and letters above the optical axis *GK* belong to the vertical, while those below *GK* belong to the horizontal meridian. In the horizontal meridian we have for the anterior focal distance of cornea $A_1{}^{\mathrm{H}} = \frac{r}{n-1}$ if r and n have the meaning formerly given. We also know that the posterior focal distance of cornea $F_1{}^{\mathrm{H}} = \frac{rn}{n-1}$ and as we call $\frac{1000}{F_1{}^{\mathrm{H}}}$ the refractive power of the cornea in the horizontal meridian $= D^{\mathrm{H}}$ we have $F_1{}^{\mathrm{H}} = \frac{1000}{D^{\mathrm{H}}}$ and therefore we have $A_1{}^{\mathrm{H}} = \frac{1000}{nD^{\mathrm{H}}}$. Let now the crystalline lens suspended in aqueous and vitreous humor have a focal distance of F_2 and let it be δ *mm* away from the apex of the cornea, then we find by the use of Helmholtz's well known formulæ for uniting two optical systems with known cardinal points into one: that the first principal point $H_1{}^{\mathrm{H}}$ of the eye, or the combined system of cornea and lens in the horizontal meridian, lies at $H_1{}^{\mathrm{H}} = \frac{\delta A_1{}^{\mathrm{H}}}{F_2 + F_1{}^{\mathrm{H}} - \delta}$ behind the cornea. This by our former values for $A_1{}^{\mathrm{H}}$ and $F_1{}^{\mathrm{H}}$ becomes $H_1{}^{\mathrm{H}} = \frac{1000\,\delta}{n(1000 + (F_2 - \delta)D^{\mathrm{H}})}$. By the same formulæ we find for the distance of the second principal point of the eye from the second principal point of lens

(h_2) the value $H_2{}^{\mathrm{H}} = \frac{\delta\, F_2\, D^{\mathrm{H}}}{1000 + (F_2 - \delta)\, D^{\mathrm{H}}}$. In the same way we obtain for the corresponding values in the vertical meridian $H_1{}^{\mathrm{V}} = \frac{1000\, \delta}{n(1000 + (F_2 - \delta)D^{\mathrm{V}})}$ and

$H_2{}^{\mathrm{V}} = \frac{\delta\, F_2\, D^{\mathrm{V}}}{1000 + (F_2 - \delta)D^{\mathrm{V}}}$, where $D^{\mathrm{V}} = \frac{1000}{F_1{}^{\mathrm{V}}}$ is the refractive power of the cornea in the vertical meridian, and the other quantities are the same as before. Again we find by the same theorem the distance of the anterior focal point of the eye from the first principal point $H_1{}^{\mathrm{H}}$, which we call A^{H} the value $A^{\mathrm{H}} = \frac{F_2\, A_1{}^{\mathrm{H}}}{F_1{}^{\mathrm{H}} + F_2 - \delta}$ which is $= \frac{1000\, F_2}{n(1000 + (F_2 - \delta)D^{\mathrm{H}})}$. We also find $A^{\mathrm{V}} = \frac{1000\, F_2}{n(1000 + (F_2 - \delta)D^{\mathrm{V}})}$. But it must be remembered that this A^{V} is reckoned from $H_1{}^{\mathrm{V}}$ as the figure (4) indicates. The distance F^{H} of the posterior focal point of eye from $H_2{}^{\mathrm{H}}$ is $F^{\mathrm{H}} = \frac{1000\, F_2}{1000 + (F_2 - \delta)\, D^{\mathrm{H}}}$, and the same distance in the vertical meridian from $H_2{}^{\mathrm{V}}$ is $F^{\mathrm{V}} = \frac{1000\, F_2}{1000 + (F_2 - \delta)D^{\mathrm{V}}}$.

Let us now suppose that both our cylinders are placed at the distance d from the first principal point of the horizontal meridian or at $d - H_1{}^{\mathrm{H}}$ from the cornea. Then we have for the combined system of cylinder, with the focal distance f, and horizontal meridian of the eye, the following formulæ:

$$h_1{}^{\mathrm{H}} = \frac{df}{d - A^{\mathrm{H}} - f} \qquad A^{\mathrm{H}}_{\mathrm{C}} = \frac{A^{\mathrm{H}} f}{A^{\mathrm{H}} + f - d}$$

$$h_2{}^{\mathrm{H}} = \frac{dF^{\mathrm{H}}}{d - A^{\mathrm{H}} - f} \qquad F^{\mathrm{H}}_{\mathrm{C}} = \frac{\mathrm{F^H\, f}}{A^{\mathrm{H}} + f - d}$$

Here $A^{\mathrm{H}}_{\mathrm{C}}$ means the anterior focal distance of the *combined* system of cylinder and eye in the horizontal meridian, and is reckoned from $h_1{}^{\mathrm{H}}$, which itself is reckoned from the centre of the cylindrical lens. The other quantities have corresponding values. The same formulæ we can write down for the vertical meridian, only remembering that the cylinder has now the focal distance f_1, and that it is placed not at d from $H_1{}^{\mathrm{V}}$, but at $d - (H_1{}^{\mathrm{H}} - H_1{}^{\mathrm{V}})$ from it. Then we have

$$h_1{}^{\mathrm{V}} = \frac{[d - (H_1{}^{\mathrm{H}} - H_1{}^{\mathrm{V}})]\, f^1}{d - (H_1{}^{\mathrm{H}} - H_1{}^{\mathrm{V}}) - A^{\mathrm{V}} - f^1} \qquad A^{\mathrm{V}}_{\mathrm{C}} = \frac{A^{\mathrm{V}} f^1}{A^{\mathrm{V}} + f^1 - \left\{d - (H_1{}^{\mathrm{H}} - H_1{}^{\mathrm{V}})\right\}}$$

$$h_2{}^{\mathrm{V}} = \frac{[d - (H_1{}^{\mathrm{H}} - H_1{}^{\mathrm{V}})]\, F^{\mathrm{V}}}{d - (H_1{}^{\mathrm{H}} - H_1{}^{\mathrm{V}}) - A^{\mathrm{V}} - f^1} \qquad F^{\mathrm{V}}_{\mathrm{C}} = \frac{F^{\mathrm{V}} f_1}{A^{\mathrm{V}} + f^1 - \left\{d - (H_1{}^{\mathrm{H}} - H_1{}^{\mathrm{V}})\right\}}$$

Now to find the value of f in the horizontal meridian it is clear by the diagram that the following equation must be satisfied, if the cylinder f shall bring the rays to a focus at the retina. $h_2^{\mathrm{H}} + F^{\mathrm{H}} = F_{\mathrm{C}}^{\mathrm{H}} + a$. Here a means the axial deviation of the eye, which in our figure is supposed to be hypermetropic. From this equation we have, after substituting the values before found, $a = \frac{F^{\mathrm{H}}\,A^{\mathrm{H}}}{A^{\mathrm{H}} + f - d}$ If we now call the cylinder that corrects the horizontal meridian $\triangle$, expressed in dioptries, and which we must find by actual trial, then, as of course $\triangle = \frac{1000}{f}$, we get $a = \frac{\triangle\,F^{\mathrm{H}}\,A^{\mathrm{H}}}{1000 + (A^{\mathrm{H}} - d)\,\triangle}$ (I)
or if we substitute the values for F^{H} and A^{H} then

$$a = \frac{\triangle\,1000^2\,F_2{}^2}{(1000 + (F_2 - \delta)\,D^{\mathrm{H}})\,[n\,(1000 - d\,\triangle)\left\{1000 + (F_2 - \delta)\,D^{\mathrm{H}}\right\} + 1000\,F_2\,\triangle]}$$

In the vertical meridian the following equation must be satisfied, as will be again seen by Fig. 4:

$F_{\mathrm{C}}{}^{\mathrm{V}} - h_2{}^{\mathrm{V}} - (H_2{}^{\mathrm{V}} - H_2{}^{\mathrm{H}}) = F^{\mathrm{H}} - \mathrm{a}$, because we suppose that our cylinder corrects the ametropia. Substituting, again we find

$$\frac{F^{\mathrm{V}}\left\{f^1 - d + H_1{}^{\mathrm{H}} - H_1{}^{\mathrm{V}}\right\}}{A^{\mathrm{V}} + f^1 - d + H_1{}^{\mathrm{H}} - H_1{}^{\mathrm{V}}} - \frac{1000\,\delta\,F_2\,(D^{\mathrm{V}} - D^{\mathrm{H}})}{[1000 + (F_2 - \delta)\,D^{\mathrm{V}}]\,[1000 + (F_2 - \delta)\,D^{\mathrm{H}}]}$$
$$= \frac{1000\,F_2}{1000 + (F_2 - \delta)\,D^{\mathrm{H}}} - \frac{\triangle\,F^{\mathrm{H}}\,A^{\mathrm{H}}}{1000 + (A^{\mathrm{H}} - d)\,\triangle} \quad \text{(II)}$$

From this equation f^1 can be found. But instead of developing further this equation (II), let us take two special cases, which are of importance for the questions raised before.

The first will be to find the correcting cylinders when they are placed in contact with the cornea, when therefore $d = H_1^{\mathrm{H}} = \frac{1000\,\delta}{n\,(1000 + (F_2 - \delta)\,D^{\mathrm{H}})}$. We must remember that the cylinder for the horizontal meridian is always supposed to have been found by actual trial, as it is impossible to find the axial change of the living eyeball in any other way. Calling then $\triangle$ the cylinder that corrects the axial ametropia of the horizontal meridian *if placed in contact with the cornea*, we find f^1 or the focal distance of the vertical cylinder also in contact with the eye by equation (II) in which d is made $= H_1^H$. Doing that in (II) and substituting for A_1^V F_1^V H_1^V H_1^H the former values, we find, after a simple but somewhat tedious calculation, the simple equation

$[\Delta - n(D^V - D^H)]\, f^1 = 1000$, or $\frac{1000}{f^1} = \Delta - n(D^V - D^H)$. This is then the cylinder that corrects the vertical meridian, while Δ is that for the horizontal one. The whole correction can therefore be written: Δ *sph.* $\frown$ $- n(D^V - D^H)$ *cyl. ax* ∥ meridian of greatest r. We see that the corneal astigmatism of $(D^V - D^H)$ dioptries is corrected at the cornea by a $n(D^V - D^H)$ dioptry cylinder, or the correcting cylinder is n (= 1.3365) times greater than the real corneal difference in refractive power $(D^V - D^H)$.

Let us now for a moment put our problem in the usual way, as it was taken also by Donders. Let us ask what is the cylinder that must be placed at the cornea in front of the *vertical* meridian if it shall bring the parallel rays of light to the same focus behind the cornea as in the *horizontal* meridian, *leaving the lens and retina out of consideration altogether.* Helmholtz's theorem again gives us, if $A_1{}^H$ $A_1{}^V F_1{}^H$ $F_1{}^V$ have the meaning formerly assigned to them, the value for the new posterior focal distance of the combined system of cylinder and vertical meridian of cornea $= \frac{F_1{}^V f^1 f''^1}{A_1{}^V + f''}$. This of course must be equal to F_1^H, and so we have $F_1{}^H = \frac{F_1{}^V f''}{A_1{}^V + f''}$ which, after substituting the former values for $F_1{}^V$ and $A_1{}^V$ gives $\frac{1000}{f''} = - n(D^V - D^H)$. This is the same cylinder that we obtained before for the correction of $(D^V - D^H)$, when we took the whole eye with lens and position of retina into consideration, so that for lenses in contact with the cornea the simple assumption suffices very well. But we shall see soon that, though there is no difference between the two cylinders when they are in contact with the cornea, there is considerable difference when we place them at d *mm* from the cornea. At present we must observe that *Javal has made his calculations of the steps so that each corresponds not to* $D^V - D^H$ *but to* $n(D^V - D^H)$; that is, *Javal does not give the real corneal astigmatism independent of a glass; but he gives us the cylinder, which* IF PLACED IN CONTACT WITH THE CORNEA, *will correct* $D^V - D^H$, *i. e.,* *the difference in the refractive power of the two main meridians of the cornea.* This is the cause why he makes his steps each 5 *mm.* For we have seen before that $D^V - D^H = \frac{336.7\,(O^1 - O)}{2\,n\,281 \times 3} = \frac{O^1 - O}{6.7}$. Now $n\,(D^V - D^H) = \frac{(O^1 - O)\,n}{6.7} = \frac{O^1 - O}{5}$. If therefore $n\,(D^V - D^H) = 1$, that is, if there is required a cylinder of 1 dioptry, we find $1 = \frac{O^1 - O}{5}$, from which is evident that for each dioptry O^1 must be 5 *mm* larger than before. Javal then is *perfectly right* when he makes his steps 5 *mm* broad, as then each step corresponds to one dioptry increase in the correcting cylinder, but he *is wrong* when he puts on his arc numbers for the refractive power of the cornea which are *n* times too great. His cylinder, touching the cornea, indeed is $n\,(D^V - D^H) = n\,D^V - n\,D^H$, but the refractive power in each meridian is not $n\,D^V$ and $n\,D^H$ as he makes it, but only D^V and D^H.

However, it is impossible to wear our cylinders in contact with the cornea, as Javal's calculation supposes. We usually wear them about 14 *mm* away from the eye, about at its anterior focal point. We must now see what changes that makes in the cylinders. Let us then suppose that we put our lenses at the anterior focal distance of the horizontal meridian, and that again we found by actual trial the cylinder Δ which corrects the axial ametropia of the horizontal meridian *at that distance* from the eye.

The cylinder f^1 (or in dioptries $\frac{1000}{f^1}$) for the vertical meridian can then be found from equation (II) by making *d* in it $= A^H$ which gives

$$\frac{F^V\,(f^1 - A^H + H_1{}^H - H_1{}^V)}{A^V + f^1 - A^H + H_1{}^H - H_1{}^V} - \frac{1000\,\delta\,F_2\,(D^V - D^H)}{[1000 + (F_2 - \delta)\,D^V]\;[1000 + (F_2 - \delta)\,D^H]}$$

$$= \frac{1000\,F_2}{1000 + (F_2 - \delta)D^H} - \frac{\Delta\,1000\,F_2{}^2}{n\,[1000 + (F_2\;\delta) - D^H]^2}$$

Into this equation we put now the values for F^V A^V A^H $H_1{}^H$ and $H_1{}^V$ when after reducing and cancelling we get

$$\frac{1000}{f^1} = \frac{\Delta - A + \frac{\Delta\,A\,(F_2 - \delta}{n\,(1000 + (F_2 - \delta)\,D^H}}{1 - \frac{A\,(F_2 - \delta)}{n\,[1000 + (F_2 - \delta)\,D^H]} + \frac{\Delta\,A\,(F_2 - \delta)^2}{n^2\,[1000 + (F_2 - \delta)\,D^H]^2}}$$

Here A means $n\,(D^V - D^H)$ that is Javal's astigmatism; so that it shows us the relation between the needed cylinder and that given by Javal's instrument. Remembering that the cylinder for the horizontal meridian is Δ we can now write for the whole correction:

$$\Delta\ sph. \bigcirc - A \left\{ \frac{1 - 2\Delta \frac{(F_2 - \delta)}{n[1000 + (F_2 - \delta)D^H]} + \frac{\Delta^2 (F_2 - \delta)^2}{n^2[1000 + (F_2 - \delta)D^H]^2}}{1 - \frac{A(F_2 - \delta)}{n[1000 + F_2 - \delta)D^H]} + \frac{\Delta A (F_2 - \delta)^2}{n^2[1000 + (F_2 - \delta)D^H]^2}} \right\} \text{cyl. (III)}$$

If we further put $\frac{F_2 - \delta}{n[1000 + (F_2 - \delta)D_H]} = B$ we can write for the cylinder that corrects the astigmatism

$$\text{Cyl} = -A\left\{\frac{1 - 2B\Delta + \Delta^2 B^2}{1 - AB + A\Delta B^2}\right\} \text{(IV)}$$

It is clear by this formula that the correcting cylinder is not given any more by A or Javal's cylinder but that it depends:

1. On the amount and sign of A as given by Javal.
2. On Δ, the amount and sign of the axial ametropia.
3. On the focal distance F_2 of the crystalline lens.
4. On the distance δ the crystalline lens is placed behind the cornea.

Of these four factors A and can be Δ accurately found by experiment, but to find in each case in practice F_2 and δ would be impracticable. Javal's instrument, therefore, gives us only approximately the correction even for the corneal astigmatism, *though we have supposed the lens to be perfectly spherical.* The amount of discrepancy between our cylinder and that given by Javal must now be determined numerically. In order to do that, we have to make a certain assumption about F_2 and δ. Let us then suppose that F_2 and δ had the values which are given to them by Helmholtz in the second edition of his *Physiological Optics* that is, $F_2 = 50.6$ *mm* and $\delta = 5.7$ *mm.* We will, further, make $D^H = 32.15$ dioptries, which would correspond to a corneal radius of 7.8 *mm*, the average value found by Donders, and finally accept for n, the refractive index of cornea and aqueous humor, the value 1.3365. Then $B = \frac{(F_2 - \delta}{n[1000 + (F_2 - \delta)D^H]}$ becomes 0.01375 and $B^2 = 0.00019$. The correcting cylinder then becomes

$$\text{Cyl.} = -A\left\{\frac{1 - 0.0275\,\Delta + 0.00019\,\Delta^2}{1 - 0.0137\,A + 0.00019\,\Delta A}\right\} \text{(V)}$$

The simplest case now will be that in which there is no axial ametropia. Here $\Delta = O$ and our cylinder (V) becomes

Cyl. $= -A\left\{\frac{1}{1 - 0.0137\,A}\right\}$. As here the influence of Δ is absent; we find rather close approximation to Javal's numbers as the following two tables will show, where a positive A means an astigmatism with the rule and a negative A one against the rule:

A	Correcting Cylinder.	A	Correcting Cylinder.
+ 1	− 1.014	− 1	+ 0.98
+ 2	− 2.056	− 2	+ 1.94
+ 3	− 3.13	− 3	+ 2.88
+ 4	− 4.25	− 4	+ 3.75
+ 5	− 5.37	− 5	+ 4.67
+ 6	− 6.54	− 6	+ 5.54
+ 7	− 7.75	− 7	+ 6.38
+ 8	− 9.	− 8	+ 7.20

Only in 8 D astigmatism as given by Javal, do we have a difference of a whole dioptry, but it will be observed that this difference of a whole D may be positive or negative according to whether our corneal astigmatism is with or against the rule. It is clear from this, that if there is no axial ametropia, only in values of A as high as 4 need there be made any correction. But it is different if axial deviation, and especially a high one, is present. We will show that by a number of combinations, refraining from giving full tables with all the possible combinations of Δ and A and only select a few of the more striking examples. The numbers under Δ are the spheres experimentally found, those under A the numbers given for the astigmatism by Javal's instrument, and the third column gives the full correction as found by formula (III).

Δ	A	Full Correction.	Δ	A	Full Correction.
+ 1	− 3	+ 1 ○ + 2.80 cyl.	− 5	+ 5	− 5 ○ − 6.16 cyl.
+ 1	− 7	+ 1 ○ + 6.25 cyl.	+ 4	− 7	+ 4 ○ − 6.50 cyl.
+ 2	− 2	+ 2 ○ + 1.80 cyl.	+ 6	+ 2	+ 6 ○ − 1.7 cyl.
+ 2	− 3	+ 2 ○ + 2.75 cyl.	− 6	+ 2	− 6 ○ − 2.5 cyl.
+ 2	− 6	+ 2 ○ + 5.25 cyl.	+ 6	− 2	+ 6 ○ + 1.64 cyl.
− 2	+ 3	− 2 ○ − 3.50 cyl.	+ 6	− 8	+ 6 ○ + 6.11 cyl.
− 2	+ 4	− 2 ○ − 4.50 cyl.	+ 7	+ 3	+ 7 ○ − 2.50 cyl.
− 2	+ 6	− 2 ○ − 6.90 cyl.	− 7	+ 2	− 7 ○ − 2.47 cyl.
+ 3	− 2	+ 3 ○ + 1.75 cyl.	− 7	+ 3	− 7 ○ − 3.75 cyl.
+ 3	− 4	+ 3 ○ + 3.50 cyl.	− 8	+ 5	− 8 ○ − 6.6 cyl.
− 3	+ 4	− 3 ○ − 4.6 cyl.	+ 1	+ 5	+ 1 ○ − 5.25 cyl.
− 3	+ 8	− 3 ○ − 9.75 cyl.	− 10	+ 2	− 10 ○ − 2.7 cyl.
+ 4	− 3	+ 4 ○ + 2.5 cyl.	+ 10	− 2	+ 10 ○ + 2.75 cyl.
+ 5	− 3	+ 5 ○ + 2.5 cyl.	+ 10	− 5	+ 10 ○ + 3.5 cyl.
+ 5	+ 2	+ 5 ○ − 1.75 cyl.	− 10	+ 5	− 10 ○ − 7. cyl.
− 5	+ 2	− 5 ○ − 2.4 cyl.	− 20	+ 2	− 20 ○ − 3.36 cyl.

From this table it is evident that in lower degrees of axial ametropia the difference between Javal's astigmatism and the corrected cylinder is not very great, unless at the same time the amount of corneal astigmatism itself is considerable; usually from .25 to .75 cyl., positive or negative, is all the correction necessary. However, in the higher degrees of myopia or hypermetropia, the deviation may be very considerable, amounting even to 2 D or more. Take for example a case, where keratometry shows an astigmatism of 5 D; then this according to the few cases of our table would be corrected by — 6.16 or — 6.6 or + 3.5 or — 7 D cylinder according to the accompanying △. We might think then that this corrected value for the cylinder would explain the discrepancy between the keratometric and the clinical findings.[1] But unfortunately it is not so! On the contrary, one frequently finds that the corrected calculated cylinder for the corneal astigmatism is still farther off from the one actually found with the trial-case. Lately I observed a case of myopia of — 7 D, which by two examinations showed a corneal astigmatism of 2 D with the rule and ought to have been corrected by a cylinder of — 2.5 D. Still this case did refuse any minus or plus cylinder and had with — 7.D sph. V = $\frac{6}{6}$. We shall return to this case later on.[2] At present I want to emphasize by it that even our correction by no means always offers an explanation for the difference, but sometimes may even make it greater. *And still it is only these corrected cylinders, that ought to be compared with those found by the trial case, because they are at the same place in front of the eye.*

How then must we explain this divergence? One partial cause of it, it seems to me, lies in the usual way of making the keratometric observations. The patient is simply told to look into the middle of the tube, while the measurements are being made. But what do we do then? We certainly make the observations in the visual line. However, it is not the visual line, but the optical axis of the eye passing through the corneal apex, that ought to coincide with the optical axis of the keratometer. For our object is to measure the two main meridians of the cornea and these go through the apex but not through the visual line,—at least not usually. Mostly the angle α is quite a measurable quantity, amounting often to 7°, 8°, and even 10°, and must be considered. It would lead me too far here to explain how it can be done with Javal's or any other good keratometer; it suffices to call attention to this frequent source of error as one that ought not to be neglected. But even if we do avoid this error, we by this do not by any means always get rid of the difference. In his later observations Donders was very careful to measure his meridians through the corneal apex, and still he found frequently a great difference between A and the trial-cylinder. In his celebrated book *On the Anomalies of Accommodation and Refraction of the Eye*, 1864, he gives, on page 493, an elaborate table of fifteen cases in which the refraction for each principal meridian was carefully determined by three different subjective methods, then the cornea was measured *in twelve different meridians through its apex*, and from these data the astigmatism of the whole eye and that of the cornea were determined. In none of these cases did the astigmatism for the whole eye agree with that calculated from the cornea, neither in its amount nor in its direction. I shall only select four cases in which I allowed myself to change the denomination of the lenses by focal inches into that by dioptries, and to add one (2d) column to show what cylinder ought to have been placed at the anterior focal distance of the eye; making the assumption that one meridian of the cornea as well as F_2 and δ had been normal in the sense before mentioned.

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[1] Sometimes indeed it does so, as in a case observed a few days ago, where Javal showed 1.5 D. Astig. with rule axis 45°. Here was an axial myopia of — 18.D. which would change Javal's 1.5 into 2.5 D. cyl. ax. 45°. She really chose herself — 18.⬭ — 2.75 cyl. ax. 45°.

[2] This case is only one of many others observed in the office of Dr. W. Thomson of Philadelphia, who kindly allowed me to make use of this case for this paper.

Calculated Corneal Astigmatism.	Corrected Cylinder.	Whole Correction Found by Trial.	Calculated Astigmatism of Crystalline Lens.
3.6 D ax. 63°.	3.25 D	+ 1. ◯ + 2.3 cyl. ax. 40°.	2.6 D ax. 173°.
5.2 D ax. 78°.	4.5 D	+ 2. ◯ + 3. cyl. ax. 74°.	2.2 D ax. 174°.
1.4 D ax. 148°.	1.25 D	+ 4. ◯ + 1.5 cyl. ax. 88°.	1.5 D ax. 174°.
6. D ax. 105°.	5.75 D	− 1.75 ◯ + 3.50 cyl. ax. 104°.	2.4 D ax. 18°.

From this table it will be seen that the cylinder calculated for the position in front of the cornea comes a little nearer to the true cylinder in the third column, but is still wide off from the mark. What other causes must be looked for besides the two mentioned? I believe with Donders, that often an astigmatic action of the lens has to be postulated. This action is usually supposed to be due to an oblique position of the crystalline, which indeed has sometimes been observed in cases of astigmatism after a trauma; but I do not see why in the usual cases we should not have resource also to a real curvature astigmatism. *A priori, a curvature astigmatism of the lens with its* TWO *surfaces is just as possible or rather more so than one of the cornea with only* ONE *curved surface* and that of the cornea having been proved to exist, we are justified in assuming one for the lens if necessary. Of course, the cornea having about 32 D refractive power, while the lens has only 20 D, and is besides nearer to the retina, it is clear that the corneal astigmatism must be of greater influence, but that of the crystalline cannot be neglected. This admitted we can then state our problem thus. If in a given case the cornea produces a certain amount of astigmatism A_c that has been exactly calculated, but if actual trial by glasses proves the astigmatism of the whole eye A_o to be different, what must then be the astigmatism of the lens A_l in order to produce together with A_c the observed A_o? This calculation has been given by Donders. But as it involves a knowledge of the curvature of surfaces it would take too much time and space to develop all the formulæ here. Suffice it to say that only when the meridians of the astigmatism of cornea and whole eye coincide, can we say that $A_c + A_l = A_o$, or what is the same, that the astigmatism of the lens equals the difference between that of the cornea and the whole eye. Generally the direction of the axes plays too important a part to allow of that simple formula. This will be apparent by the 4th column of the last table, which was calculated by Donders. The third example is perhaps the most instructive of all, showing that the values of the corneal astigmatism and the whole eye may be almost identical, but still a high lenticular astigmatism be present, namely, if the axes are very different. It must, however, be added that the lenticular astigmatism, as given in the 4th column, is in fact even higher than as there given, because it is calculated for a crystalline in actual contact with the cornea. But the lens lies about 6 *mm*[1] deeper, and therefore must have a higher astigmatism, in order to produce there the same effect as at the cornea. We see, besides, from the last table, that on the whole the lenticular astigmatism is opposite in its effects to that of the whole eye, so that the astigmatism of the whole eye is almost always much less than it would be if the cornea alone was at fault. This proves, I believe, conclusively, that there is a static lenticular astigmatism in many eyes; for Donders paralyzed the accommodation in these cases, and so did away with any *dynamic* astigmatism. It would be out of place here to discuss this *dynamic* astigmatism, due to an unequal contraction of the ciliary muscle; but I assert that it must be excluded if a mydriatic has been thoroughly used. However, in spite of this evidence for a lenticular astigmatism, it has been asserted by a high authority, that it would suffice to correct the corneal astigmatism as found by Javal's ophthalmometer, without the use of a mydriatic. The question about the mydriatic we will leave undiscussed, though I do not see how then the dynamic astigmatism of the lens, advocated in the same quarter, can be gotten rid of, unless it is supposed that this dynamic astigmatism has its only cause in the corneal astigmatism, and is given up when this has been corrected. However that may be, one thing is certain, that we are obliged to admit a static lenticular astigmatism which cannot be neglected.[2] It must be taken into account by supplementing keratometry by the subjective method, which latter cannot be replaced or superseded by any objective examination. And here it must be stated that even those who assert to correct astigmatism by keratometry alone do not rely upon it altogether; on the contrary, they almost always reduce the keratometric finding by at least 0.50 D. Let us take, *e.g.*, a paper by Dr. Roosa in the *Medical Record* of March 26, 1892, in which he claims to cure many cases of asthenopia by simply correcting the corneal astigmatism. Let us then suppose that every cure was *propter hoc* and not *post hoc.* What does his paper prove? *It simply proves that he does not correct the corneal astigmatism alone.* Take, *e. g.*, Case 8., in which the patient was under the influence of atropine when tested, and in which, therefore, there can be had no resource to a dynamic lenticular astigmatism. Here he finds by the ophthalmometer in O. D. one dioptry of corneal astigmatism with the rule, axis 30° from 90°, therefore at 60°. He gives, however, a + .50 cyl. ax. 45°, therefore .50 D less and with the axis 15° off. In this case we can neglect the correction for the position of the cylinder 14 *mm* from the cornea, as it does not reduce the cylinder to less than 0.95 D. We have therefore to look for another cause, and leaving out of consideration the defects of Javal's instrument, calculation shows that there must be in this case a lenticular astigmatism of 0.62 D with axis at 174° 54′. But as the crystalline lens in this calculation is supposed to be in contact with the corneal apex, it must have a still higher astigmatism in its real position. *We see, therefore, that, far from correcting only the corneal astigmatism, there was also corrected at the same time an astigmatism of the crystalline, amounting to more than* 0.62 *D.* Why then not admit this? Knapp's words, written more than thirty years ago (*Gräfe's Arch.*, Bd. viii., Abth. 2, p. 240), are as correct to-day as they were then. "After one has found the amount and direction of the asymmetry of the eye, the ophthalmometer decides whether the seat of it lies principally in the cornea or in the crystalline lens. For purely practical purposes this is superfluous, for upon therapeutics it has no determining influence."

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[1] This refers to the distance between cornea and first principal point of the crystalline.

[2] Even Javal himself admits having seen a case of *static lenticular astigmatism of two dioptries.* (*Mémoires d'Ophtalmométrie*, par Javal, p. 121.)

Keratometry is a valuable method, no doubt, but it is no substitute for the subjective one. This is also well shown in the last July number of the ARCHIVES OF OPHTHALMOLOGY, where Dr. G. Melville Black gives some striking examples of the great discrepancy that sometimes exists between the findings by the keratometer and those by the usual testing. He gives there, *e. g.*, a case of a patient aged sixty, who in the right eye had $- 4.50 \bigcirc - 1.$ cyl. ax. 180° $= \frac{20}{20}$, though the ophthalmometer indicated 2 D astigmatism against the rule, which would have required for its correction either a + 2.40 cyl. ax. 180° or a − 2.4 cyl. ax. 90°. Instead of this it was corrected by − 1. cyl. ax. 180°. This can be only explained by an astigmatism of the lens of more than 3 D with the rule. I repeat, therefore, that the crystalline lens cannot be disregarded in the correction of astigmatism. At the same time keratometry is one of the most valuable methods for a more perfect diagnosis of the actual build of the eye.

It can even teach us something more, to which, as far as I know, attention has never been called before, I mean something about the length of the eyeball. Let me explain by an example. Reference was made above to a case in which there were found 7 D myopia with $V = \frac{6}{6}$ and corneal astigmatism of 2 or even 2.5 D. Here no cylinder did improve the vision, and we are justified in assuming that there was an astigmatism of the crystalline of a little more than 2 D with its axis at right angles to that of the cornea. But the 2 D over curvature of the vertical corneal meridian and the 2 D over curvature of the horizontal meridian of the lens must produce a myopia of 2 D, just as two positive cylinders of each + 2 D with their axis at right angles to each other are equivalent to a + 2 D sphere. The case referred to, which had a normal horizontal corneal radius of curvature, had, therefore, probably only 5 D axial myopia, the remaining two being produced in the way indicated. By the same reasoning, but a little more lengthy calculation, it will also be found in the Case 8 of Dr. Roosa mentioned above, that there is produced a myopia of 0.56 D. One only needs refer to the well-known fact that two cylinders in general are equal in their effect to a new cylinder and a sphere; but the complete formulæ by which the exact quantities can be calculated need not be given here, as they can be found in Donders, *loc. cit.*, pp. 499 and 500. By means of careful observations with a good keratometer, therefore, we get a more perfect understanding of the dioptric apparatus of the eye. It may sometimes even affect our prognosis.

But here must be mentioned another difficulty that is due to the very construction of Javal's instrument. The corneal image has a size of about 3 *mm*, and the area of the cornea used for reflecting the images of the two mires into the telescope is about 0.5 *mm* in breadth, and lies about 1.25 *mm* to either side of the point of the cornea towards which the optical axis of the instrument is directed. If, then, the patient looks into the instrument, or, better still, if he looks so at a point of the large disk that the corneal axis coincides with the axis of the telescope, all we do find with Javal's ophthalmometer is not the radius of curvature (r) of the point looked at, but $r \cos i$, if the cornea was perfectly spherical, and if i is the angle of incidence of the rays which are reflected from the cornea into the telescope. This angle i amounts here to about 10°, and can therefore not be neglected as it can be in Helmholtz's ophthalmometer. Even with a perfect sphere, this circumstance would make the values about two per cent. too great. *But in cases of astigmatism we do not have to do with a spherical cornea but rather with a triaxial ellipsoid, where the formulæ used by Javal for his calculations do not apply.* For in a triaxial ellipsoid each point of the surface has two main radii of curvature, and it depends upon which one of the two focal lines furnished by each point is looked at in order to get the one or the other of these two radii. For example, taking Knapp's first case, in which he determined the ellipticity of the cornea, we find that for a point in the horizontal meridian 1.25 *mm* off from the axis the two principal radii of curvature would be resp. 7.84 and 7.79 *mm*, which if we applied Javal's formula $D = \frac{1000(n-1)}{r}$, would give 43.0 and 43.3, a difference therefore of $\frac{1}{3}$ dioptry. What at the best and by the most complex formulæ we measure with Javal's instrument are the radii of curvature of the cornea at points 1.25 *mm* off from the corneal axis. *But this ring-shaped zone of about* 0.5 *mm breadth is not the whole cornea used in direct vision, a great part of it is left unexplored with the instrument, and it depends therefore upon this remaining area whether the astigmatism observed is little or much deviating from that obtained by subjective methods.*

This difference in the refractive power of the different zones of the cornea has also been justly advocated by Tscherning in Javal's *Mémoires d'Ophtalmométrie* to explain the discrepancy between the diagnosis with and without a mydriatic. It certainly shows that there is no need of the theory of a dynamic astigmatism; but space forbids to enter further into the discussion of this interesting question.

So far we have treated of an eye that contained a lens. Let us now take the rarer but more interesting case of aphakia, where we have only one refractive system.

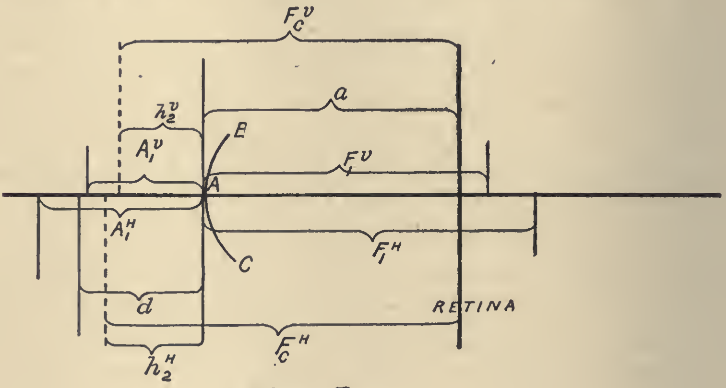

Fig. 5

In the diagram *BAC* is the cornea, and *a* the distance of the retina from the corneal apex, while the other letters have the same meaning as before. Suppose we found that a cylinder △ at the distance *d* from the cornea did correct the horizontal meridian, then, in the same way as before, by Helmholtz's theorem we easily find

$$\frac{1000}{f^1} = \frac{1000\,\triangle - (1000 - d\,\triangle)\,A}{1000 - (1000 - d\,\triangle)\frac{d\,A}{1000}}$$ [1]

if f^1 is the focal distance of the cylinder that corrects the vertical meridian, and if we put $n\,(D^V - D^H) = A$ as we did before. Writing now our two crossed cylinders as a sphero-cylindrical combination, we have for the full correction

$$\triangle \text{ sph.} \frown - A \left\{ \frac{\left(1 - \frac{d\,\triangle}{1000}\right)^2}{1 - \frac{d\,A}{1000} + \triangle\,A\left(\frac{d}{1000}\right)^2} \right\} \text{cyl.}$$

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[1] This becomes the same formula as that given on page 53, if we put here $d = O$, as it ought to be.

If we now put $d = 13.75$ *mm*, we get for the correct cylinder not A, as Javal gives it, but

$$- A \left\{ \frac{(1 - 0.01375\ \Delta)^2}{1 - 0.0137\ A + 0.00019\ \Delta\ A} \right\}$$ which is the same as (V), where a lens was present in the eye. But there is this great difference between the two formulæ, that the first one (V) is only right for certain average values of F_2 and δ, while this last is independent of F_2 and δ and strictly correct if d is made $= 13.75$ *mm*, *i. e.* if the glasses are placed at that distance from the cornea. Cases of aphakia are therefore the ideal field for keratometry, but owing to the high spheres usually necessary, there is a great difference between the correcting cylinder at 14 *mm* from the eye, and that in contact with the cornea, which latter, as we know, is given by Javal's instrument. The following table will show this at a glance, which is given for + 10 D for far, and + 14 D for reading:

A	Δ	Full Correction.	A	Δ	Full Correction.
+ 1	+ 10	+ 10 ⊂⊃ — .75 cyl.	+ 1	+ 14	— 14 ⊂⊃ — .66 cyl.
— 1	+ 10	+ 10 ⊂⊃ + .73 cyl·	— 1	+ 14	+ 14 ⊂⊃ + .65 cyl.
— 2	+ 10	+ 10 ⊂⊃ + 1.45 cyl.	— 2	+ 14	+ 14 ⊂⊃ + 1.25 cyl.
+ 2	+ 10	+ 10 ⊂⊃ — 1.5 cyl.	+ 2	+ 14	+ 14 ⊂⊃ — 1.3 cyl.
— 3	+ 10	+ 10 ⊂⊃ + 2.1 cyl.	— 3	+ 14	+ 14 ⊂⊃ + 1.8 cyl.
— 4	+ 10	+ 10 ⊂⊃ + 2.8 cyl.	— 4	+ 14	+ 14 ⊂⊃ + 2.5 cyl.
— 5	+ 10	+ 10 ⊂⊃ + 3.5 cyl.	— 5	+ 14	+ 14 ⊂⊃ + 3.18 cyl.
— 6	+ 10	+ 10 ⊂⊃ + 4.1 cyl.	— 6	+ 14	+ 14 ⊂⊃ + 3.66 cyl.

This shows conclusively the necessity of correcting in aphakia the keratometrically determined cylinder for its position and for the co-existing axial condition, for even with 1 D it amounts to .25 D and more, while for an astigmatism of 6 D against the rule it amounts to almost 2.5 D. At the same time we observe that in the same individual the cylinder may have to be reduced perceptibly for reading. We also find that the numbers obtained by the keratometer are *always* too high, no matter whether there is astigmatism with or against the rule.

In the following I give a short *résumé* of the main conclusions of this article:

1. Keratometry is a very valuable method for the finer diagnosis of the actual construction of the eye.
2. The cornea having been measured not in the visual line, but in the optical axis of the eye, we find:

a) the direction of the two main meridians of the cornea;

b) the radii of curvature in these two main meridians at 1.25 *mm*, or about 10° to either side of the corneal point looked at, the result being the more incorrect the more astigmatic the cornea;

c) the cylinder that would correct the corneal astigmatism if placed directly in contact with the cornea, and if the remaining part of the cornea not examined by the instrument does not deviate much from the employed area of the cornea;

d) the cylinder that would correct if placed at the usual distance from the eye, as found by formula (V).

3. In cases where the corneal astigmatism differs much from that of the whole eye, especially where there is no A_c, but considerable A_o, we may then find:

a) the axis of the lenticular astigmatism;

b) the amount of the crystalline astigmatism;

c) the sphere resulting from the combined action of the corneal and lenticular astigmatism.

CONGENITAL PTOSIS WITH SYNCHRONOUS MOVEMENTS OF THE AFFECTED LID AND LOWER JAW.

By ALVIN A. HUBBELL, M.D.,

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(*With three illustrations.*)

T. W. B. is a boy now seven years of age. He is one of a family of three children whose parents are healthy and intelligent Americans. No malformation is present in any of them, except himself, and none is known to have existed in either the paternal or maternal ancestors. This boy is well developed, healthy, and unusually intelligent. He has a symmetrical and well-shaped head and face, and were it not for the ptosis on the right side he would be quite a handsome lad. Soon after birth it was noticed that the right eyelids did not open with the left, but would always remain closed, excepting when the mouth was opened, and then they would separate and close again with the closure of the mouth. This condition has continued without any apparent change to the present time. On examination I find that when the boy's mouth is closed the right eyelids are also closed, and there is not the slightest movement of the upper lid when the left eyelids are ordinarily opened, or the left eyeball is directed upwards, or when any other movement is made by which the eye or head is turned, or the face drawn, or the lower jaw carried to one side. Figure 1 shows the appearance of the boy's eyes when he is looking forward, with his mouth closed. If the boy is asked to open both eyes as widely as he can, the right upper lid is raised a little, as shown in Figure 2. But this is done entirely by the action of the occipito-frontalis muscle and not in the least by the levator palpebræ. When, however, the mouth is opened, the right upper lid is involuntarily and unconsciously raised at once. The greater the depression of the lower jaw the higher is the upper lid lifted. In other words, the contraction of the right levator muscle takes place involuntarily with the contraction of the depressor (digastricus) of the lower jaw, and exactly proportionately to that of the latter. This action, however, can be overcome by the orbicularis palpebrarum, whose function is normal on both sides, since the right eye can be voluntarily kept closed while the mouth is opened. When the right eyelids are separated, the eye is seen to be of the same size, and the iris of the same color as the left ; but there is marked divergent strabismus together with

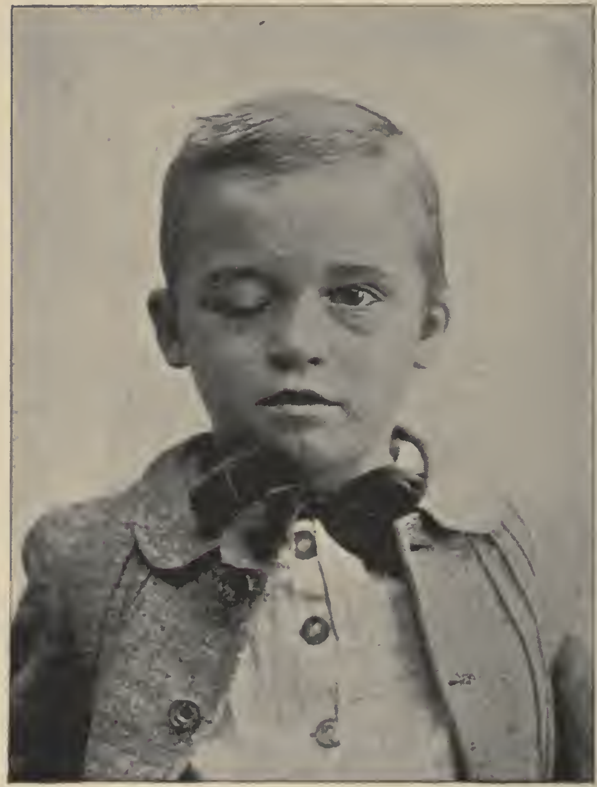

FIGURE 1.

some downward deviation. The eye cannot be turned upwards beyond the median plane, or inwards but little beyond the vertical plane; but downwards and outwards its movements are of usual, or perhaps more than usual extent. The pupil and iris are normal in appearance, size, and reflexes, and are like the left. The refraction of both eyes is, by the ophthalmoscope, emmetropic.

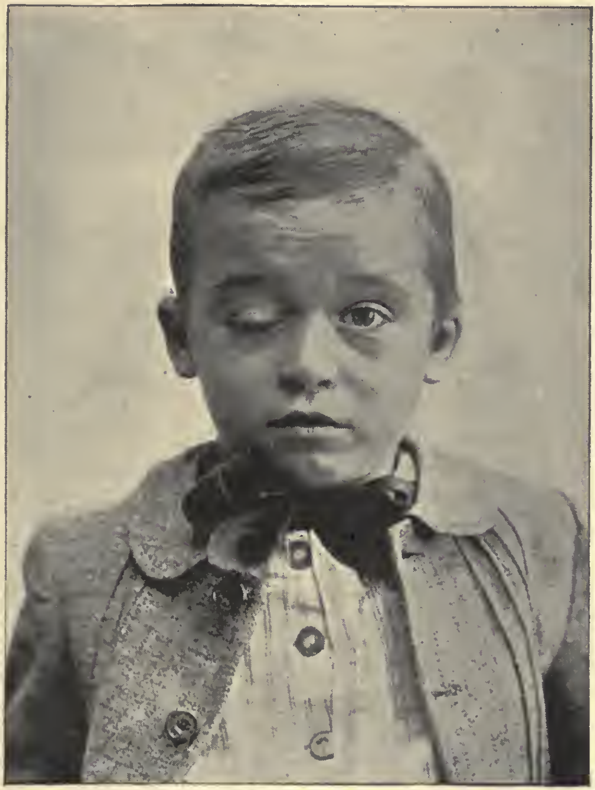

FIGURE 2.

The fundus of the right eye is, like the left, normal in appearance in every respect. But the vision of this eye is amblyopic, being able barely to count fingers at four feet, while that of the left is normal, reading number 6, Snellen, at six metres ($\frac{6}{6}$). Figure 3 shows the appearance of both eyes when the mouth is widely opened.

Remarks.—So far as I know, fifteen cases of this anomaly have been reported. While they have differed somewhat in some particulars, they have all had ptosis on one side with rising of the drooping lid synchronously with some movement of the lower jaw, generally depression. In no case has a post-mortem and histological examination of the brain been made. Hence the anatomical basis of these anomalous movements is at present merely conjectural. But taking into consideration the fact that the innervation for the levator palpebræ and the digastricus or other muscle of the lower jaw is in these cases undoubtedly one and the same, as shown by the associated movements of these muscles,

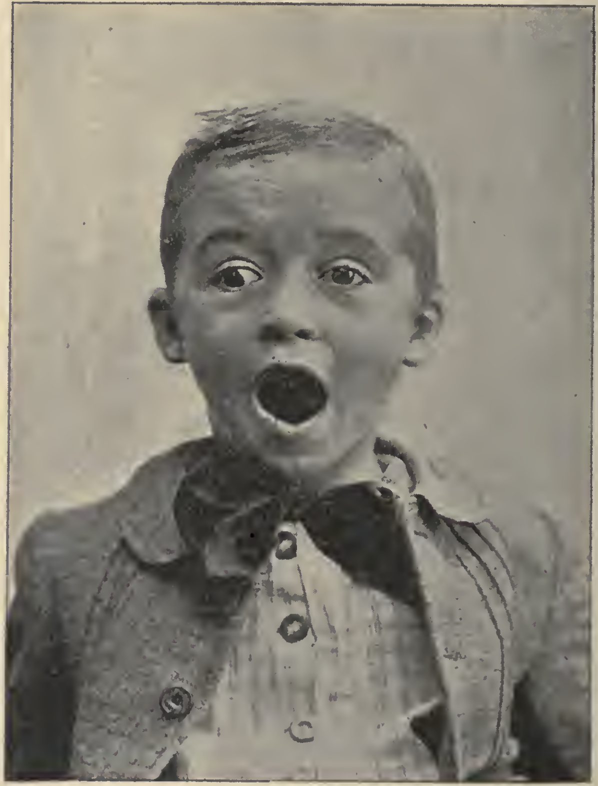

FIGURE 3.

and that a part of the nucleus of the descending motor root of the fifth and the nucleus of the root of the third nerve are in close proximity to each other in the neighborhood of the aqueduct of Sylvius, the supposition becomes very probable that an abnormal connection is here established. This abnormal nuclear transposition may vary in different cases, but it appears always to be from some part of the third to some part of the descending root of the fifth nerve. A lack of proper development of the nucleus of origin of more or less fibres of the third nerve appears also to be a prominent characteristic in all cases. In my own case I believe that the origin of the fibres supplying the levator muscle has been transferred from the nucleus of the third nerve to that part of the nucleus of the fifth which sends fibres to the anterior belly of the digastric muscle. The nucleus of the third nerve seems to be undeveloped in that portion from which arise the fibres supplying the levator of the upper lid, the superior rectus, and the internal rectus muscles, while that part sending fibres to the inferior rectus (possibly the inferior oblique) and the iris is normally present. Thus do we get in this case the ptosis, the divergent strabismus, the downward deviation, and the associated movements of the upper lid with the lower jaw.

A CASE OF TOTAL IRIS ABSENCE.

By L. D. BROSE, M.D., Ph.D.,

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The mother, Mrs. F., brought her second child, a nine-months-old baby to me, saying ever since its birth she has noticed that it had peculiar eyes. The infant was well nourished and well formed, and save for a side-to-side movement of its eyes, lateral nystagmus, presented nothing out of the way to a non-medical observer. Upon closer examination and with focal illumination a total absence of the iris was found. The suspensory ligament can be seen surrounding the entire lens circumference, while the lens itself occupies a normal position, is of the usual size, and without opacities. With the ophthalmoscope and a plane mirror the fundus is easily illuminated, and a difference in the lens refraction and that through the suspensory ligament distinguished. The eye is hypermetropic, but the degree, as well as more than a fleeting view of the optic nerve and macula region, was denied us, because of the increased eye movements when brought in contact with a bright light, and the tendency of the infant to close the eyelids and bury the organ from the illumination. Neither malformation nor lesion of any kind was seen in any part of the fundus oculi. Tension of eyeball normal. Transverse diameter of the cornea, 9 *mm.* Distance from the inner to the outer canthus, 23 *mm.* The whites of the eyes clear, and the eyes withal, so far as size and development other than above noted, in keeping with what one usually finds in a well developed and well nourished infant at nine months.

Although many of the reported cases of irideremia presented the appearance of total iris absence, yet in the few cases that have come to a post-mortem examination at least a rudimentary development of the iris was always found. In one case reported by H. Lembeck (*Hirschberg's Centralblatt für Augenheilkunde*, supplement, 1891) the membrane of Descemet had divided into two layers and enclosed the rudimentary iris, which had formed an intimate union with the cornea and sclera beneath the canal of Schlemm. In two additional cases, reported by E. Treacher Collins (*Ophthalmic Review*, March, 1891), the ciliary body formed the rudiment, although so small in size as to have remained undiscovered through the cornea. The proper explanation of this malformation is in all probability that of an intra-uterine inflammation involving the iris or its vicinity during the early stages of its development. In support of this view are the pathological changes noted by G. Rindfleisch, assistant in the eye clinic at Heidelberg, and reported in *Graefe's Archiv für Ophthalmologie.* In his specimens, taken from an old lady of fifty-one years, there was a ring-like furrow at the inner side of the corneo-scleral junction of exactly the size of the rudimentary iris just back of it. The possibility of this contact between the iris and furrow-like impression was all the more probable because of traces of previous perforation of the eyeball permitting the aqueous humor to escape, and a partial dislocation of the lens forward, carrying the iris against the cornea, and through pressure retarding its growth. At a later period, when the perforation closed, the eye was fully developed, the re-formation of aqueous restored the lens to its proper place, liberated the iris again, but with no tendency to perfect its development. This inflammatory theory likewise explains why glaucoma is so frequently met with in irideremic eyes, the natural filtration being in part or wholly prevented by the partial or complete closure of the communications between the canal of Schlemm and the anterior eye chamber.

A CASE OF SYMPATHETIC NEURO-RETINITIS WITH PLASTIC IRITIS; RECOVERY; MICROSCOPIC EXAMINATION OF THE ENUCLEATED EYE.

By Dr. T. Y. SUTPHEN, Newark, N. J.

Armin B., a bright, healthy-looking boy, nearly five years of age, was brought to me October 20, 1892. Two months previously, while in the country, he had injured the *right* eye by the thrust of a table-fork. There was only slight inflammation following, and the parents, as well as the physician in attendance, thought the injury was not serious. Within a few days previous to his coming to my office, it had been discovered that the child did not see with that eye. I found the right eye sightless, smaller than its fellow; tension greatly reduced; iris discolored and bulging, and a yellow reflex from the vitreous chamber. In the ciliary region, at the lower border of the cornea, was a sunken cicatrix, while a small gray scar was seen in the cornea, near the temporal side. The pericorneal injection was slight. In the *left* eye there was some photophobia. The ophthalmoscope showed clear media, but a well-defined neuro-retinitis—the neuritis predominating. Immediate enucleation of the injured eye was advised, but the advice seemed so shocking and sudden that the parents declined to accept it without further counsel. Accordingly the child was taken to Dr. Knapp the same day, who, besides advising an immediate operation, urged that a careful microscopic examination of the affected globe and optic nerve should be made, with the view of establishing, in a measure, the theory of the migration of germs as the causation of the sympathetic trouble. The injured eye was removed on the following day Dr. W. S. Disbrow assisting me. Microscopic slides were made from fluid pressed out from the nerve stump, and the globe immediately placed in a sterilized bottle, and taken to Dr. Knapp for examination. On dilating the pupil of the left eye, strong and broad adhesions were found, which yielded only after several days' use of a mydriatic. The child was kept quietly in bed, in a darkened room, and mercury with chalk administered, in 2-gr. doses, night and morning, for three weeks. The sympathetic inflammation steadily subsided, and when the boy was seen last, on Dec. 30, 1892, all signs of the neuritis had disappeared, and vision was $\frac{20}{20}$. Dr. Ward A. Holden, who kindly made the microscopic examination, and to whom I am greatly indebted, sends the following statement :

" At the inferior sclero-corneal margin is an indrawn cicatrix involving the ciliary body. There has been a general plastic cyclitis, more marked near the cicatrix, with the formation of a fibrous membrane stretching across the ball behind the lens, which has produced a total detachment of the retina and a partial detachment of the ciliary body.

" The choroid in its posterior half, and particularly near the papilla, shows a diffuse cellular infiltration, with small scattered foci of denser infiltration (uveitis maligna, Brailey).

" The intraocular portion of the optic nerve shows beginning atrophic changes, similar to those in the detached retina. Otherwise the nerve and its sheaths are unchanged.

" The examination of cover-glass preparations of fluid from the optic nerve for bacteria was negative. Gelatine tubes inoculated with scrapings of the nerve, after sterilization of the surface, and with fluid from the interior of the eye, were sterile.

" No micro-organisms were found in sections of the eye after hardening in alcohol."

The case is such a clear one, and the examinations for bacteria were so carefully made, that it serves to establish the fact that sympathetic inflammation of the nerve and iris may occur without the existence of migratory germs traceable with the means at our disposal thus far.

ON EMBOLISM OF THE CENTRAL ARTERY OF THE RETINA.

By Dr. ANTON ELSCHNIG,

ASSISTANT TO THE UNIVERSITY EYE CLINIC IN GRAZ.

(*With three figures in the text, and two plates, Tab. II. and III. of vol. xxiv., German Edition.*)

Translated and Abridged by Dr. Ward A. Holden.

THE cases to be reported here came under my observation in the Graz eye clinic while this institution was under the direction of my esteemed teacher, Prof. Schnabel.

Case 1.—G. J., a woman of fifty-six, was received Nov. 14, 1887, for a sudden blindness of the left eye, coming on five days previously. She had a moderate-sized goitre, an atheromatous aorta, and hypertrophy of the left half of the heart. The disc and the surrounding retina were white, the retinal vessels very small, the veins on and near the disc pulsating. In the macular region was a circumscribed dark-red patch. V = perception of light.

Nov. 15*th*, at 8 A.M., the retinal opacity is grayish. 10 A.M.—A pulsating centripetal movement of the blood column in the principal veins.

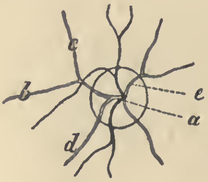

Fig. 1.

Nov. 17th, 8 A.M.—At the origin of the inferior nasal artery the red blood column is interrupted by a white patch of cylindrical form, having a process toward the central artery (Fig. 2, *e*).

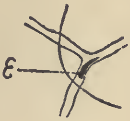

FIG. 2.

Spontaneous venous pulsation; slight arterial pulsation on pressure. The retinal opacity less marked.

Nov. 19th.—The median twig of the superior nasal artery shows a white patch near its origin. No arterial pulsation on pressure. At the inferior margin of the pupil a small hemorrhage.

Nov. 21st, 5 P.M.—From the central artery short red blood cylinders push into the white superior nasal artery (Fig. 1, *a*) and on into its branches (*b*, *c*). In the course of an hour the movement ceased. Then from the twig *b* the blood passed centripetally, partly into the main branch, partly into the twig *c*; later the blood in the large artery *a* moved centrifugally into the twig. This process was frequently repeated. Pulsation in veins. 7.30 P.M.—Pulsation in central artery; *a*, bloodless; *d*, filled with blood. Veins small; no pulsation.

Nov. 22d, 8 A.M.—Marked pulsation in the central artery; the superior nasal artery empty. 10 A.M.—*a*, filled with blood, which moves rhythmically in the normal direction. 11 A.M.—In *a* no movement of the blood and none in the central artery. The entire circulation stops suddenly for a time and then begins again. In the periphery the pigment epithelium shows light patches.

Nov. 23d.—Circulation more active, but only in the arteries. The arteries are all small near their origins, and are normal in size or larger farther out. Arterial pulsation on pressure. The disc dirty-gray, the inner and lower margins sharp. The retina clearer in its nasal portion, temporally and particularly about the macula still opaque.

Dec. 7th.—On the disc, which has an opaque yellowish-white color, a loose gray tissue has formed in the supero-temporal quadrant, and projects into the vitreous, carrying fine vessels and vascular networks. This tissue increases in the following days. The red spot in the macula loses its sharp contour, and becomes stippled with white.

Dec. 19*th*, 20*th*, and 21*st*.—Circulation of an interrupted or granular blood column clearly seen in the twigs of the upper papillary artery.

Dec. 22*d*.—With diastole a blood column pushes from the central artery into the upper papillary artery *e*, and returns in a granular condition.

The nasal half of the disc assumes a more bluish-green color and a transparent appearance; the vascular formations increase. The white patch in the inferior nasal artery remains unchanged. Some arteries become thread-like, so that it is impossible to follow them. In the neighborhood of the disc to the temporal side there are striated hemorrhages. The dull-yellow patches in the pigment epithelium have appeared near the disc.

When discharged, four months after her admission, the disc had a sharp outline, was white, and in the centre greenish, the vessels narrow, an embolus in the inferior artery, a fine network of vessels covering the entire disc; the wall of the arteries on the disc all thickened; the pigment epithelium of the nasal half of the retina irregular, and showing numerous round yellow spots reaching to the disc; the macular region more darkly pigmented, but showing the same changes as the remainder of the fundus; the remains of numerous hemorrhages near the disc; pulsation of the papillary vessels on pressure.

CASE 2.—*June* 17, 1890, I examined in the medical department, T. H., a woman of fifty, who was somnolent, aphasic, and hemiplegic. The pupils are of equal size, the left irresponsive to light, but reacting consensually. The nasal and inferior margins of the disc are indistinct, the retina pale but transparent, and almost lead-colored near the macula. The superior papillary artery is well filled, the other retinal vessels are small. The inferior artery is simply a white cord, in the twigs of which a small blood column reappears. The veins are thin everywhere. The right eye normal. The patient had a hypertrophied heart of irregular action, and albuminuria. On June 13th she became suddenly unconscious, right hemiplegia with facial paralysis, hemianæsthesia (slight), and motor aphasia. This condition has not changed. The patient before this attack had not complained of her sight.

June 18*th*, 10 A.M.—The nasal portion of the disc is covered with a thick white cloud. The inferior papillary artery is quite white, its twigs only here and there containing blood. The superior papillary artery and its branches are filled with blood, and each branch of the first order is larger in calibre than the main artery. The blood column is continuous. The veins as dark-red cords without a reflex may be followed uninterruptedly to their junction in the central vein. No small papillary vessels visible.

In the macula there is an oval cherry-red, fairly sharply contoured spot.

June 18th.—The cloudiness of the disc and retina is increased. An interruption of the blood current appeared at times in the superior artery and its branches. Some of the larger arteries show a thickening and cloudiness of their walls.

June 19th.—The superior and inferior papillary arteries are still white. The superior retinal arteries are well filled and tortuous, the inferior narrow, and the blood column interrupted. Very strong and repeated pressure on the ball produces scarcely a change in the blood cylinders, and there is no sign of pulsation. Formation of cholesterine in the macular region. In the veins the column is granular, and moves in a centripetal direction with a varying rapidity.

June 20th.—Disc whiter and more cloudy. The papillary arteries have a very thin blood column, no circulation in the veins.

Cloudiness of retina less marked, and calibre of the vessels increased in the days following. The macular spot becomes darker and irregular in form, and loses its sharp outline.

July 8th.—The narrowing of the inferior papillary artery extends to its temporal branch which ½ disc diameter from its origin regains its normal calibre. The light patches in the macula change from day to day, and resemble more and more the changes found in albuminuric retinitis, without having so regular an arrangement. Arterial and venous pulsation can be produced by pressure.

Aug. 3d.—The disc white, outline sharp. The retinal veins of normal size. The arteries almost obliterated on the disc, but of nearly normal calibre in the periphery. The light spots in the macular region cannot be clearly seen, and are scattered over the retina, giving it a variegated appearance. On this day the patient died.

Autopsy.—Between the thalamus and corpus striatum and the internal capsule, the cerebral substance shows a necrotic softening. The same change is found in the posterior portion of the lenticular nucleus and in a small portion of the external capsule. Internally the focus reaches the wall of the third ventricle. The vessels of the base of the brain are very rigid. The walls of the vertebral artery are so thick as to almost obliterate its lumen. The arteria fossæ Sylvii is completely blocked at its origin with a red thrombus, beyond which it is empty. The heart is greatly enlarged, the muscles lax; the aorta thickened. Diagnosis: encephalomalacia from thrombosis of the arteria fossæ Sylvii, atheroma of the cerebral arteries, dilatation of the heart.

The contents of the left orbit, with the entire optic nerve, and the internal carotid artery from its exit from the carotid canal, and the right eye and optic nerve, were removed and hardened in Müller's fluid.

The macular region was removed from the rest of the ball, and then the nerve, retina, and choroid were cut into small pieces, some of which served for teased preparations, the others being cut in serial sections in various directions. Preparations were stained with hematoxylin-eosin, picrocarmine, and according to Pal's modification of Weigert's method.

Microscopic Examination—Vessels.—The lumen of the internal carotid at its emergence from the carotid canal is filled with a thrombus which rests on the vessel walls, and which has a coarsely granular appearance, being composed partly of concentric layers and partly of anastamosing threads of homogeneous material and irregular globules. At points the thrombus does not rest on the wall, and the free lumen so left is filled with closely packed blood corpuscles. The vessel wall shows an atheromatous degeneration.

The central end of the thrombus could not be followed in the carotid canal, but peripherically it extended nearly to the origin of the ophthalmic artery, and from this point on into the ophthalmic artery a thrombotic mass adherent to the vessel wall narrowed the lumen without obliterating it. This latter portion of the thrombus is of later date, and the corpuscles composing it are better preserved.

The ophthalmic artery and its direct branch, the central artery of the retina, have a free lumen, the intima being thickened in places by the presence of a striated tissue with spindle-formed nuclei, a change often found—particularly in the optic canal—in old persons.

The central artery enters the nerve 10 *mm* from the sclera, and passes to the centre, where it runs directly to the ball. Just after its entrance into the nerve it gives off a large vessel, which divides, one branch accompanying the central artery to the lamina cribrosa, and the other bending backward and breaking up into a great number of twigs which run in the connective tissue between the nerve bundles (the artery first described by Vossius, *Arch. f. Ophth.*, vol. xxix., 4, p. 143).

The central vein divides into its principal branches behind the lamina cribrosa; the central artery divides into the superior and inferior papillary artery near the surface of the disc, after having previously given off a number of small papillary twigs. In the intrabulbar portion of the artery there are the same changes that were found in the ophthalmic artery, which were also found in the artery of the normal right eye. Within the ball the central artery has a narrow cleft-shaped lumen, the delicate endothelium is regular, the elastica folded in the normal manner.

The first portion of the inferior papillary artery resembles the central artery, its middle portion showing the following characteristic changes. The lumen is narrowed by an irregularly spindle-shaped deposit on and in the walls.

Peripheral end of the new formation (Fig. 1, Plate II.). Diameter of artery, exclusive of adventitia, 0.12 *mm.* Muscularis and elastica well preserved. The lumen is contracted to a kidney form by a sharply contoured formation, which is separated from the elastica by a thick layer of delicate fibres, between which lie proliferation cells and slender intima nuclei. The formation rests on the lateral anterior wall of the vessel like a gall on an oak leaf. The surface of the formation toward the lumen is covered with an endothelial layer which is continuous with the endothelium lining the remainder of the vessel wall. The endothelial layer is partially detached from the thickened intima, but this is a post-mortem change.

The formation is from 0.026–0.035 *mm* in diameter, stains faintly with eosin, and scarcely at all with carmine or hematoxylin. Highly magnified, its periphery is smooth, containing a few nuclei from the intima, its centre coarsely granular.

The central end of the formation (Fig. 2, Plate II.) is more complicated. The lumen of the vessel is eccentric, elliptical, 0.025–0.033 *mm* in diameter, lined with an endothelial layer. The deposit here is larger than in its peripheral portion. In its superficial layers, on all sides, are cells, partly identical with the intima cells, partly similar to young connective-tissue cells. By a proliferation of the intima on either side of the deposit, the sharp angles seen in Fig. 1 are obliterated, and the lumen is not kidney-shaped, but elliptical.

The elastica is well preserved; the regular stratification of the cellular layers of the muscularis is somewhat interrupted by the presence of a finely fibrous tissue; the adventitial connective tissue is sclerotic, with here and there isolated or grouped round cells.

The last portion of the inferior papillary artery shows a free round lumen, a normal muscularis, a thickened intima, and groups of round cells in the sclerotic adventitia.

The superior papillary artery is in many respects similar to the inferior. Besides the changes in the walls, there is a slight deposit on the intima, bounded by endothelial cells.

Twigs of the Inferior Papillary Artery.—Near the margin of the disc the papillary artery divides into a temporal and a nasal twig. The thick connective-tissue sheath accompanying the central vessels becomes thinner after the division, but forms a fairly thick adventitial sheath for the branches. The lumen is of normal size and free, the muscularis and endothelium of normal appearance, the muscularis separated from the connective tissue of the adventitia by groups of small round cells.

Just beyond the margin of the disc, a marked change appears in the inferior nasal artery. It is bounded from the retinal tissue by a thick layer of round cells, and its walls are sclerotic. In place of the endothelium there is a loose delicately meshed tissue, not smoothly bounded toward the narrowed lumen. The smaller twigs are sclerotic, and some of them are obliterated.

Twigs of the Superior Papillary Artery.—The superior papillary artery divides near the margin of the disc into a small nasal artery and a large temporal artery. The temporal artery is sclerotic. The eccentric narrow lumen is surrounded by a layer of dense connective tissue, with numerous spindle-formed nuclei, and between this and the tunica propria is a layer of loosely meshed connective tissue.

Macular Region.—Since the arteries and veins of this region show more marked changes than in the remainder of the retina, they will be described by themselves.

1. *Upper Macular Region.*—The arteries here are so changed as to be scarcely recognizable. The muscularis is wanting; the outer sheath, sharply limited from the surrounding retina, consists of a finely fibrillar connective tissue, which replaces the muscularis. Internal to this sheath is a layer two or three times thicker, containing a few intima cells and many round cells, lined with endothelium, and enclosing a lumen of varying width. The lumen contains closely grouped but normally staining blood-vessels. The spongy character of the tissue, which has apparently developed from the intima, is rendered clearer by the presence of blood corpuscles in it. There is no sharp separation of the two layers by an elastic membrane.

Between the two arteries running to the macula is a larger oval vein. Its walls consist of loose, wavy connective tissue inserted between the outer and the inner endothelial layer.

2. *Lower Macular Region.*—The inferior nasal artery is best preserved. It has a wide lumen, a normal or slightly thick-

ened endothelium, which is separated from the sclerotic propria by the wrinkled elastica. Nearer the periphery there are numerous cellular plaques between the elastica and the inmost endothelial layer, and round cells in and near the outer sheath. Two millim. from the macular elevation is an artery, 0.06 *mm* in diameter, which is almost entirely obliterated (Fig. 3, Plate II.).

The folded propria consists of concentric layers of sclerotic connective tissue. The contents of the vessel consist of a cellular spongy tissue with blood corpuscles.

Periphericaliy, the chronic inflammatory changes in the vessel wall are more marked than near the disc. The arteritic plaques become more numerous, and near the macula the smaller vessels are blocked by an endarteritis.

Résumé.—The central artery of the retina and the ophthalmic artery have a free lumen, and show no other pathological changes in their walls than are found in the well eye. In the inferior papillary artery there is a plug which has retained its original character at its peripheral end only, being here, however, covered with endothelium, and at its central end is in an advanced stage of organization by the proliferation of the intima and the migration of cells into the thrombus. This cannot be considered as an atheromatous plaque, but is certainly an embolus. The same may be said of the analogous changes in the superior papillary artery. Here the embolus was originally smaller, and is now more highly organized than in the inferior papillary artery.

The retinal arteries and the peripheric veins show less marked chronic inflammatory changes, which may be called arteritis and phlebitis prolifera.

The collections of blood corpuscles in the new-formed connective tissue are to be explained as having passed through small ruptures in the endothelium into the spongy tissue.

The Papilla.—The temporal half consists of connective-tissue bundles continuous with those of the lamina cribrosa. There is no trace of nerve fibres to be seen. The nasal half projects nearly twice as far above the choroidal plane as the temporal half. The lamina cribrosa is convex backward.

The papillary tissue retains its normal structure in so far as the preservation of the supporting substance of some of the nerve bundles, but has no nerve fibres. Everywhere there are numerous vessels of larger calibre than normal entering the disc with the connective-tissue tracts; and, besides these, there are a number of sclerotic twigs from the central artery.

The disc passes over into the retina in the following manner (Fig. 7). The loose connective tissue, with numerous glia cells forming the inmost portions of the disc, is arranged parallel to the surface of the disc, and continues, as delicate tracts, into the retina, exactly as if the nerve-fibre bundles were present.

Temporally where all the layers of the retina are present, the retina does not end where the choroid ends, but pushes over into the disc. On the nasal side all the layers of the retina end regularly at the margin of the disc.

In a small crescent-shaped portion of the retina near the disc, all the layers can be distinguished. Beyond this portion the retina consists of five layers only (Fig. 3, Plate II.). The internal layer consists of the nerve-fibre, ganglion-cell, and inner reticular layers. The inner nuclear and all the outer layers are preserved.

I.—The inner layer (Fig. 3, 1) consists of Müller's fibres and nuclei; the cavities are filled with granular albuminous masses. No ganglion cells can be found.

II.—The inner nuclear layer (Fig. 3, 2) consists of a single stratum of elliptical pale granular nuclei, belonging to the supporting fibres of Müller.

III.—The outer reticular layer (Fig. 3, 3) is not sharply bounded, and is of varying thickness. In some parts it is quite thin where the nuclei of the outer nuclear layer have pushed through until they have reached the nuclei of Müller's fibres.

IV.—The outer nuclear layer (Fig. 3, 4) has its natural arrangement, but is rarefied, as the nuclei have pushed into the reticular layer.

V.—The rods and cones show only the ordinary post-mortem changes.

The changes in the retina in general may then be said to be the disappearance of all the nervous elements of the cerebral layer of the retina.

The Fovea.—In place of the usual fovea with elevated margins, there is a round patch about the size of the disc, sunken, smooth, of dark-brown color, adherent to the choroid, and not detaching readily like the remainder of the retina.

A fovea centralis does not exist. The entire thinned portion has a thickness of 25–40 μ, and consists of two layers without a sharp line of demarcation. The inner layer is composed of a delicate network of fibres similar to Müller's fibres, but crossing in various directions and mostly running parallel to the surface of the retina, having pale oval nuclei and numerous small very thin-walled vessels.

The outer layer is composed of dark homogeneous nuclei similar to the elements of the outer nuclear layer, and epithelioid cells crowded for the most part closely together. In the centre the limitans externa and the rods and cones are wanting. The cells lie free on the outer surface of the retina, and among them are found pigment cells entire or in fragments.

The region of the fovea consists, then, of a richly vascular connective tissue, fibrous in its inner portion and rich in cells in its outer, in which there are remains of the elements of the outer nuclear layer.

The retina is best preserved in its upper half, where the circulation was soonest re-established. Otherwise the changes are fairly uniform in the entire retina, excepting a portion of the nasal and a portion of the temporal æquatorial region.

After the careful removal of the retina, the choroid is seen to be covered with a somewhat irregular pigment epithelium. In its lateral portions the pigment epithelium is covered with a delicate albuminous membrane (Fig. 5, *a*). The pigmentation of the epithelium is very irregular, and particularly so where the albuminous membrane is thickest (Fig. 5, *p* at left).

There are two degenerated patches in the retina near the equator of the ball, one to the temporal and one to the nasal side. The margins of the atrophic patches (Fig. 6) consist entirely of the connective-tissue portion of the retina. The rods and cones are wanting. The pigment epithelium, partially separated from the lamina vitrea by the albuminous membrane, consists of round and irregular cells, not uniformly pigmented. In the central portion of the atrophic patches the pigment epithelium does not exist as an epithelial layer. There is here a layer as thick as the remainder of the retina, consisting of spindle-formed cells which have lost their epithelial character but retain some pigment needles. In some portions this proliferated epithelium cannot be separated from the atrophic retina where the limitans externa is wanting. Over this proliferated epithelium in some parts is a distinct vitreous membrane, so that the whole comes to resemble, in a measure, a capsular cataract (Fig. 6, *p*). The preserved portion of the retina passes quite suddenly into the atrophic patches (Fig. 5).

The choroid is normal, except for the ordinary changes of age, a moderate sclerosis of the vessels, and a slight increase of nuclei in the layer of middle-sized vessels.

The optic nerve is atrophic, the nervous tissue replaced by connective tissue. The atrophy of the nerve is less marked a little distance behind the lamina cribrosa, and posterior to the entrance of the vessels it is normal.

PREVIOUS LITERATURE.

The uncomplicated cases of embolism of the central artery, which have been anatomically examined, are as follows:

1. GRAEFE[1]–SCHWEIGGER [2]—Death one and a half years after ophthalmoscopic diagnosis of embolism. The central artery completely blocked just behind the lamina cribrosa. Cadaveric changes too marked to permit further examination.

2. SICHEL [3]—A patient with a mitral insufficiency becoming suddenly blind, and the vision then clearing up, except in a central scotoma, showed a slight dilatation of the veins; arteries of normal calibre; an extravasation at the macula, and white plaques in the retina. Four months later, the vision was rapidly reduced to perception of light. The veins were hyperæmic; the arteries degenerated to white cords for a short distance from the disc, and then regaining their calibre; in the macula, a reddish-brown patch with small white

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[1] *Graefe's Archiv.*, vol. v., 1.

[2] *Vorlesungen über den Gebrauch des Augenspiegels*, p. 140.

[3] *Arch. der Physiol.*, vol. iv., p. 83, 207.

spots. The eye was put into Müller's fluid sixty hours after death. Leber believed that there had been a partial blocking of the central artery, and later a complete thrombosis. The eye was not well preserved, and, furthermore, the case was not one of simple embolism.

3. PRIESTLEY SMITH[1] published a case in which the examination was equally incomplete. The central artery was changed into a connective-tissue cord in the optic nerve, four months after the sudden blindness.

4. SCHMIDT-RIMPLER[2]—A man of forty-eight, with complicated vitium cordis, became suddenly blind in left eye after a left hemiparesis. Twenty-four hours later, the typical picture of embolism of central artery. From the following day, chemosis, exophthalmus, irido-choroiditis, with exudation in the anterior chamber and vitreous. Four months later, small irresponsive pupils; posterior synechiæ; atrophy of optic nerves with small vessels; symptoms of chorio-retinitis, and retinal hemorrhages. Autopsy, ten months after blindness. Central artery and accompanying branch, given off at its entrance into nerve, blocked by a yellowish hyaline plug, leaving only a small lumen free. Atrophy of disc, retina, and choroid.

5. F. POPP[3] examined the left eye of a woman of sixty, who had lost her sight three years previously from embolism of the central artery. Optic nerve, nerve-fibre and ganglion-cell layers atrophic. Retina otherwise normal. No obliteration or narrowing of the lumen of the arteries.

6. GOWERS[4]—A man of thirty, with a bicuspid insufficiency. Five days after, a sudden right hemiplegia, with disturbances of speech and of consciousness; ophthalmoscopic examination showed in the left eye the picture of embolism of the central artery. Autopsy, two months later. Here and there in the vessels of the nerve and disc are small granular masses and a large plug in the central artery, not completely blocking it, one-eighth inch behind the lamina cribrosa. The fibres of the nerve showed a beginning degeneration.

The nerve-fibre layer of the retina is somewhat swollen in the neighborhood of the papilla. The remainder of the retina is infiltrated with small nuclei, similar to the elements of the nuclear layers. Macular region: at some points all the retinal layers filled with nuclei, the supporting fibres covered; at other points the fibres of the outer reticular layer separated, as in simple œdema; the nuclear layers normal; again, at other points, the nuclear layers increased in thickness, and in place of the rods and cones are nuclei, the pigment epithelium being in close contact with the outer nuclear layer.

7. HIRSCHBERG[5]—Man of forty-five, with vitium cordis, embolism of right central artery. Complete re-establishment of the circulation. Death eighteen months later. Atrophic excavation; nerve fibres and ganglion cells wanting. Central artery and vein within the nerve entirely normal. The orbital portion of the nerve almost normal.

8. SCHNABEL and SACHS[6]—A man of thirty-three, with a heart lesion, became suddenly blind in the left eye. The following day the typical picture of em-

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[1] *Brit. Med. Jour.*, April 4, 1874.
[2] *Archiv für Ophth.*, vol. xx., p. 287.
[3] Inaug. Dissert., Regensburg, 1875.
[4] *Lancet*, Dec. 4, 1875.
[5] *Centrabl. f. prakt. Augenh.*, Jan., 1884.
[6] *Arch. f. Augenh.*, vol. xv., p. 24.

bolism of the central artery was found. Nine hours later, the calibre of the artery was normal, or nearly so; in the inferior papillary artery, a white spot; in most of the veins normal circulation. Three months later, death. In the intra-laminar portion of the central artery, an embolus covered with several layers of endothelium, partially blocking its lumen, and a similar embolus in the inferior papillary artery. Some small retinal arteries show a marked thickening of their walls with a narrowing of the lumen. The optic nerve from chiasm to ball is thinner, and shows a beginning degeneration of the fibres. In the retina the nerve-fibre and ganglion-cell layer is wanting; the inner nuclear layer is thin; the outer nuclear layer and the rods and cones are normal.

The cases of Nettleship (two), Loring, and Rothmund-Eversbusch are more complicated.

Remarks.

Ligation of a single carotid artery does not affect vision or produce any marked change in the retinal circulation, since the circulation is at once restored through the medium of the circle of Willis. For this reason, thrombosis of the internal carotid cannot directly affect vision. It is possible, however, that thrombosis of the carotid and ophthalmic arteries is a frequent source of embolism of the central artery, for it is difficult to believe that every embolus in a retinal artery has been carried there from the heart.

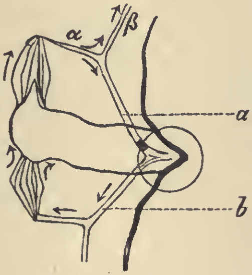

Fig. 3.

The absence of an embolus in the anatomical preparation does not prove that the clinical diagnosis was incorrect.

If some time has elapsed, there may be only a connective-tissue deposit on the intima, which may be covered with endothelium, and escape observation in a casual examination.

Schnabel, from his clinical observations and anatomical examinations, has concluded that the primary anæmia or ischæmia is due to two causes: the embolus itself, and the contraction of the arterial walls which it causes. When the contraction passes off, the blood again circulates in the channel which is not then completely blocked by the embolus. On this point I am in accord with Schnabel.

The centripetal direction of the arterial blood current may be explained as follows. The arterial trunk *a* contains an embolus. The blood in its twigs and capillaries, when stasis takes place, is under a pressure not exceeding that of the intraocular tension. The neighboring trunk *b* is free, and its circulation is normal. A vein of the inferior system anastomoses at the ora serrata (Leber, Schwalbe) with a vein of the arterial twig α. As the tension in α is less than in the other, the blood flows back into α, and passes down into *a*, and also out centrifugally in the arterial branch β, the tension of which is also low.

The cherry-red color of the macula is partly due to the contrast with the œdematous portion of the retina, but the changes which it undergoes are due to the changes in the pigment epithelium, consisting first in an increase of pigment, and later in its disappearance. These changes in the pigment epithelium are probably not due directly to the retinal anæmia, but to the collateral hyperæmia of the choroid.

Explanation of the Drawings.

FIG. 1. Transverse section of the inf. papillary artery; peripheric end of the embolus. Reichert, obj. 5, ocular III.

FIG. 2. Transverse section of the inf. papillary artery; central end of the embolus. Obj. 5, oc. I.

FIG. 3. Retina between macula and disc; vertical meridional section. Obj. 5, oc. III.

1. Inner layer (nerve-fibre, ganglion-cell, and inner nuclear layer).
2. Nuclei of Müller's supporting fibres (inner nuclear layer).
3. Outer reticular layer.
4. Outer nuclear layer.
5. Layer of rods and cones.

FIG. 4. Vertical meridional section through the centre of the disc. Obj. 3, oc. III.

FIG. 5. Horizontal meridional section through the temporal portion of the retina anterior to the equator. Obj. 3, oc. III. *p*, pigment epithelium; *a*, layer of coagulated albumen; *r*, retina.

FIG. 6. Section through the retina and choroid at the temporal atrophic plaque. Obj. 5, oc. III. *r*, retina; *p*, tissue from proliferation of pigment epithelium; *ch*, choroid.

FIG. 7. Optic papilla, upper half. Obj. 2, oc. I.

ON EMBOLISM OF A BRANCH OF THE CENTRAL ARTERY OF THE RETINA.[1]

By Dr. WARD A. HOLDEN.

(*With five figures in the text.*)

IN the month of December last the rare opportunity was offered me of examining five undoubted cases of embolism of a branch of the central artery of the retina. Four of these occurred in the private practice of Dr. Knapp, to whom I am indebted for the permission to publish them.

The few remarks following a short report of the cases will be confined to a consideration of the relation of the visual field to variations of arterial distribution, and to the manner of restoration of the interrupted circulation.

Case 1.—A man of fifty-one, noticed eight days previously a sudden blindness in his left eye which soon after regained its sight. For two days following, the vision of the eye vacillated and then within ten minutes became almost completely abolished, which condition has remained. $V = \frac{4}{200}$, eccentric, in a small field just to the temporal side of the fixation point, corresponding to an oval portion of the retina between disc and macula. The retinal arteries are somewhat contracted, the veins dilated, the retina œdematous except in its periphery and in a small area between disc and macula, in which area runs an artery whose circulation is apparently uninterrupted. There is no heart murmur, but he has been under treatment for an amyloid kidney due to syphilis. Fig. 1.

Case 2.—A man of twenty-three, eight months ago, while taking violent exercise, noticed a sudden complete blindness in left eye. The following day the lower half of objects could be seen. This condition has remained. $V = \frac{20}{20}$—. The field shows a superior hemianopsia, the blind portion encroaching somewhat on the *inferior* half of the field to the temporal side. The inferior branch of the central artery is small and does not pulsate on pressure. The upper third of the disc is of normal color, the middle third is pale, the lower third is blue and excavated. He has no heart murmur, but there is a history of albuminuria. Fig. 2.

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[1] Read before the section in ophthalmology N. Y. Academy of Medicine, Jan. 16, 1893.

CASE 3.—An unmarried woman of thirty-four a year ago noticed that with the right eye she could not see the upper half of objects. $V = \frac{20}{20}$. Field shows an irregular superior hemianopsia encroaching upon the inferior half to the nasal side, and to the temporal side reaching 15° from the median horizontal line. The inferior retinal arteries are small, some of them being almost entirely obliterated. Each branch, however, near the margin of the disc receives an anastomosing branch arising either from a superior retinal artery or from a ciliary vessel, and beyond this point is fairly well filled. The upper third of the disc is normal in color, the middle third is white and atrophic, the inferior third has a slight reddish tint where branches of cilio-retinal vessels are seen. Patient has a valvular heart lesion. Fig. 3.

CASE 4.—A married woman of thirty-three on awaking seven days ago noticed a diminution of sight in the left eye, which has remained constant. $V = \frac{4}{200}$ eccentric. The field shows a scotoma occupying the infero-nasal quadrant and including the fixation point. An embolism is seen in a horizontal branch of the superior papillary artery, which divides, sending two twigs toward the macula and a third upward. The retina about the disc is somewhat œdematous. The disc itself is normal in color. There is no heart lesion or albuminuria, but the patient has a history of syphilis, complains of severe headaches, and has a small, weak pulse. Fig. 4.

Nine days later: the œdema of the retina has disappeared. The macular region is studded with punctate glistening dots; the temporal half of the disc is atrophic. Field as before.

CASE 5.—A man of thirty on awakening five weeks ago noticed that he could not see the upper portion of objects with the right eye. Condition has remained constant. $V = \frac{20}{20}$. Field shows a hemianopsia superior with sharp inferior limit passing nearly through fixation point. Inferior branch of central artery small. Inferior two-thirds of disc pale. Valvular heart lesion. Fig. 5.

The Branches of the Central Artery.—The central artery of the retina divides just before or just after its emergence in the disc into a superior and an inferior branch. Each of these two branches in its turn divides near the margin of the disc into a temporal and a nasal branch. So we might suppose that embolism of a branch of the first order would cause a sharp superior or inferior hemianopsia, and embolism of a branch of the second order a quadrant scotoma. The matter, however, is not so simple. In many eyes there is also a small vessel, the median artery, running horizontally to the nasal side, and often also one or two small arteries running horizontally to the temporal side, toward the macula. These small horizontal vessels may, some or all, be given off the main artery low down before its bifurcation. Or they may arise from the branches of the first or second order, in which case the nasal artery usually arises from an inferior branch, and the temporal from a superior.

Taking a case in which a horizontal artery is given off below the bifurcation, if there be an embolism between this branch and the bifurcation, there will be blindness, except in a small portion of the retina supplied by this branch. Such an instance is Case 1, in which only a small macular branch is free.

Taking a case in which a lateral artery is given off from a superior or an inferior branch, if there be an embolism of this branch, the hemianopsic blind portion of the field will extend over the horizontal median line on the nasal or the temporal side, as the case may be. Such an instance is Case 2, in which a median nasal artery arises from the inferior branch, which is blocked, and to the nasal side a portion of the superior half of the retina is blind.

Taking a case in which a lateral artery is given off from a superior or an inferior branch, if there be an embolism of this artery only, there will be a scotoma varying with the distribution of this artery. In Case 4 the temporal horizontal artery which is blocked divides into two branches running to the macula, and one running upward, and there is a quadrant scotoma including the macula. The fact that the scotoma extends to the periphery makes it appear doubtful whether the superior temporal artery, which was free when the case was first seen at the seventh day, may not have been previously blocked for a time.

So far the relation of the field to the vessels blocked is fairly clear. There are, however, peculiarities in regard to the periphery of the field which are not so readily explained. It is a common experience to find in cases of embolism of the main artery a bit of peripheric field preserved, yet such small arteries as may be given off before the bifurcation of the main artery are invariably short, and do not extend to the periphery. These cases have been explained by some as being due to an incomplete blocking of the artery. Others have thought that the periphery of the retina was supplied by anastomosis with choroidal vessels at the ora serrata. In Case 2 we find a peripheric area beyond the blind portion, in which vision is preserved, apparently indicating that the temporal periphery of the inferior half of the retina is supplied by the superior vessels. The reverse of this condition is shown in Case 3, in which, far to the nasal side of the field, the blind portion passes beyond the median horizontal line, apparently indicating that the blocked inferior vessels have supplied a portion of the superior half of the retina to its temporal side.

The Re-establishment of the Circulation.—According to Leber's description, the optic nerve far back is supplied with vessels from the pial sheath. After the entrance of the central artery into the nerve, this gives off small branches. In the bulbar portion of the nerve run small vessels from the choroid, and often branches of the short ciliary arteries pass from the sclera into the nerve.

In a number of cases of embolism the cilio-retinal vessels are seen after a time to have established a capillary network on or near the disc. In cases in which there is from the beginning a small macular artery free, giving a small field near the point of fixation, some writers have supposed this vessel to be a cilio-retinal vessel, which probably in most cases it is not.

All of the recent text-books and monographs that treat particularly of this subject state that the re-establishment

FUNDUS ERECT, FIELD INVERTED IN ALL.

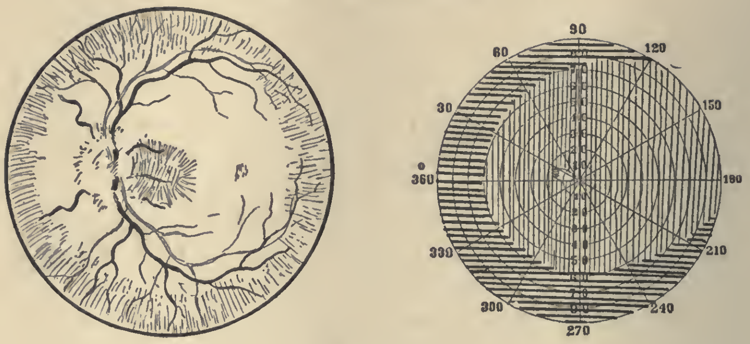

FIG. 1.
Embolism of central artery excepting macular branch (L).

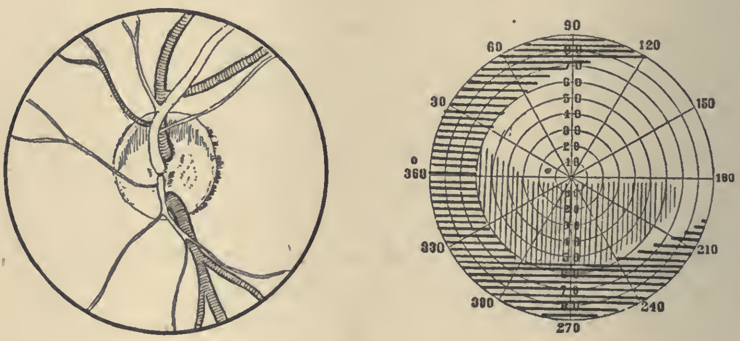

FIG. 2.
Embolism of inferior papillary artery from which median artery is given off (L).

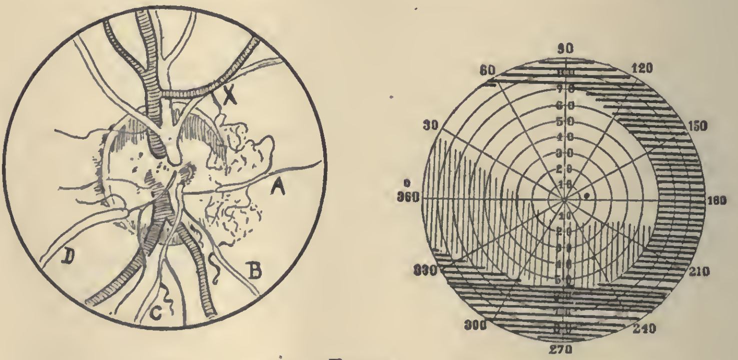

FIG. 3.
Embolism of inferior papillary artery; collateral restoration of circulation in each branch (R).

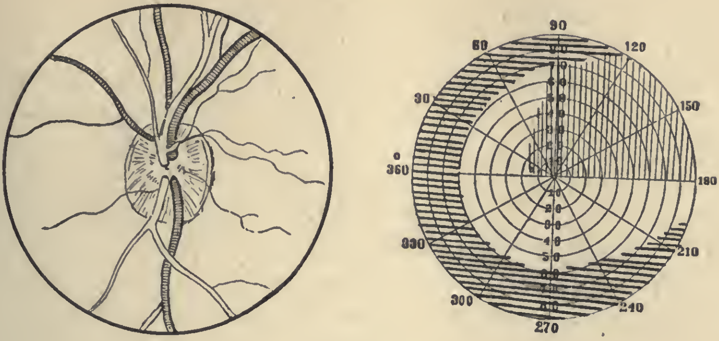

FIG. 4.
Embolism of macular branch from superior papillary artery (L).

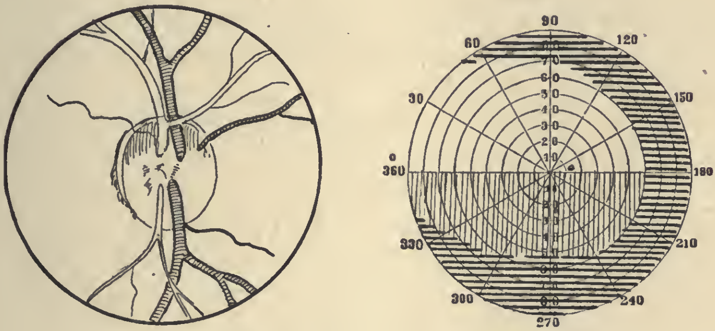

FIG 5.
Embolism of inferior papillary artery which has no lateral branches (R).

of the circulation occurs by the lumen of blocked vessels again becoming free.

Michel in his text-book says: "The re-establishment of the circulation does not occur by collateral vessels or by the so-called cilio-retinal vessels present. It is rather to be assumed that if the embolism has not blocked the artery incompletely at first, the channel soon becomes at least partially free." Noyes in his text-book speaks in a somewhat similar manner. Nettleship (text-book) says: "Sometimes the pressure test, which showed blockage of some or all branches shortly after the onset, again produces pulsation a few days later without visible evidence of collateral circulation, thus proving the re-establishment of the main channel." Nettleship, however, in the *Helmholtz Festschrift* last year, reported a case of embolism of the main artery in which there was evident anastomosis between ciliary and retinal vessels.

Our Case 3 is a very remarkable example of such anastomosis. Here there are four divisions of the inferior branch of the central artery. Each branch is small or almost obliterated near its origin, and three of the branches may be seen to receive each an anomalous anastomosing vessel, after which it nearly or quite regains its normal calibre.

In the centre of the disc (Fig. 3) is a white mass which would seem to be the remains of a blocked vessel.

From the superior nasal artery *X*, a small twig is given off which breaks up into a capillary network. This network is joined by a superior twig of an inferior nasal artery *A*, which in the papillary portion of its course is reduced to a mere thread. An inferior twig from the artery *A* joins a second capillary network below. Apparently anastomosing with this network is a dark tortuous vessel which joins the inferior artery *B*. At a corresponding point on the opposite side, *B* is joined by a second dark tortuous vessel. Centrally from the junction of these two ciliary vessels the artery *B* is a mere thread.

Artery *C* shows a blood column but is small up to a point a short distance below the disc, where it is joined by a tortuous vessel.

A small artery emerges by itself in the centre of the disc, and running inferiorly divides into two branches, one of which unites with the artery *D*. The artery *D* apparently emerges at the margin of the disc and is of normal size. It is difficult to say whether the small artery which emerges in the centre of the disc is to be considered the narrowed central portion of artery *D*, or whether it is a distinct vessel which gives off an anomalous anastomosing branch, joining artery *D*.

In the infero-nasal portion of the disc is another cilio-retinal vessel which has no apparent connection with the retinal vessels.

These cases show that, with a single embolism of a branch of the central retinal artery, we may have a field of quite irregular form, which to a considerable extent may be explained by the variations of arterial distribution; and that in cases where the lumen of an artery remains blocked, we may have a collateral restoration of its circulation by anastomosing vessels.

ON TRAUMATIC ENOPHTHALMUS.

By Dr. THEODOR BEER,[1] of Berne, Switzerland.

Translated by Dr. Ward A. Holden.

(*With one figure in the text.*)

CASES of traumatic enophthalmus, in which, after wounds or contusions in the region of the eye, the globe sinks into the orbit, are so rarely observed and have been explained in so many different ways, that a description of every case seems called for.

The following cases have been reported:

1. Himly (*Krankheiten und Missbildungen des menschlichen Auges.*, 1843, Part 1, p. 395) saw a marked enophthalmus come on suddenly after a blow in the neighborhood of the eye. The eyelids were closed and sunken, apparently as if no globe was present. When the lids were separated a ball normal in size, appearance, mobility, and vision was found. He supposed that the pulley of the superior oblique muscle had been loosened and that therefore the tendon of this muscle could not draw the eye forward.

2. Nieden (*Klinische Monatsbl. für Augenheilk.*, xix., p. 72) saw enophthalmus in the right eye of a builder on whom a mass of earth had fallen from a distance of twelve feet. No wound was discovered. The ecchymotic right half of the face regained its normal color and form eight days later. Fourteen days after the injury he found that there was something wrong with his right eye.

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[1] From Prof. Fuchs' Clinic in Vienna.

The orbital margin of the lids is marked by a sharp line, and the lids are retracted into the orbit. Both ball and lids have their normal mobility. The right ball lies about 4 *mm* deeper than the left.

Nieden explains the condition by assuming a disappearance of the orbital fat, in consequence of the long-continued and forcible compression by the mass of earth.

3. Talko (reviewed in *Klin. Monatsbl. für Augenheilk.*, xix., p. 471) saw a case in a soldier whose right eye was injured by a falling stick of wood. The sight at once began to fail and there was periodic pain above the eye.

Seven months after the injury, the right lids were retracted as in phthisis bulbi, and the palpebral fissure was decreased in size. When the upper lid was elevated the ball rolled upward. Pupil and fundus normal. In the right eye there was no vision, in the left fingers were counted at ten feet. A pulsating pain in the region of the eyes, temples, and ears, particularly at night. After some months there was complete blindness, while the pain and retraction of the ball remained as before. The right globe lay six lines behind the superior margin of the orbit, the left four and one half lines.

Talko assumes an anomaly of the trophic or vaso-motor ocular nerves, which would be indicated by the retraction of the ball, the disappearance of the orbital fat, the over-filling of the eye with blood, and the late pathological changes in the cornea.

4. Gessner (these ARCHIVES, xviii., p. 269) saw three cases. The first was a miner who was struck by falling coal and lay unconscious. He sustained a fracture of the right inferior maxilla and zygoma, and also an injury of the upper margin of the orbit. When after ten days the swelling of the lids was less and the right eye could be opened it was remarked that the right eye was smaller than the left.

At the outer two-thirds of the superior orbital margin there is a non-adherent cicatrix. The lids are sunken and the palpebral fissure is 2 *mm* shorter than in the other eye. The function of the levator is disturbed, and the mobility of the ball upward is limited. Motion downward is exaggerated, in the other directions normal in extent but sluggish. The right eye lies 3 *mm* deeper than the left. $V = \frac{3}{4}$-$\frac{3}{3}$. No diplopia. Pressure in the trochlear region causes intense pain.

In the second case a large lump of coal had fallen on a miner's forehead. Fourteen days later when the right eye was opened, it appeared smaller than the left. There is a non-adherent cicatrix at the outer two-thirds of the superior orbital margin. The upper lid is sunken. Movement of lids normal; upward movement of ball limited. Ball lies 2–3 *mm* deeper than the other. $V = \frac{1}{8}$. The amblyopia may have existed previously. Pressure into the orbit elicits pain.

The third case was a miner who was thrown down by a falling piece of coal. Right eye swollen. When it was opened fourteen days later he noticed that it was smaller than the left. There was an adherent cicatrix at the nasal third of the superior orbital margin. The upper lid is deeply sunken, and cannot be raised. Limited movement of the ball upward and outward, increased downward. Homonymous diplopia when he looks to the right. $V = \frac{3}{3}$. Ball 3–4 *mm* deeper than the other.

Gessner does not deny the possible truth of Nieden's theory of trophic disturbances in the orbital tissues, but finds a more probable cause in the orbital injury which all his cases showed. He assumes a cicatricial contraction of the retrobulbar cellular tissue following inflammation and periostitis due to the injury. With the shrinking of the tissues behind it the eyeball simply sinks back into the orbit.

5. Von Becker of Helsingfors (*Arch. für Ophth.*, xii., p. 289) reported the following case: Three months previously a peasant woman was struck in the left eye by a cow's horn so severely that she lay unconscious for four days. Blood flowed from the wound and from the nose. The left cheek was swollen and ecchymotic, sensibility almost wanting. The vision of the right eye failed.

St. pr.: At the supra-orbital margin is a non-adherent cicatrix extending from a point above the outer commissure, 25 *mm* inward. The upper lid is sunken. Beneath the supra-orbital margin is a white cicatrix in the conjunctiva. The finger may be carried 20 *mm* deep into the orbit before any resistance is encountered. The upper margin of the cornea lies two lines above the infra-orbital margin. The eye is normal. Fingers can be counted in the upper portion of the field. Ball immovable. Slight paralysis of left facial muscles. Left upper teeth somewhat sensitive. There is no foreign body producing the displacement of the ball, which is adherent to the infero-nasal wall of the orbit.

According to von Becker the cow's horn passed into the outer third of the superior portion of the orbit. The conjunctiva was torn. The ball when struck behind the equator rolled downward and inward, and was pressed forward. The horn fractured the lachrymal bone, the lamina papyracea, and perhaps also a portion of the roof of the antrum. Some of the soft parts healed in the cavity so made, and attached the ball in its present position. The branch of the oculo-motor supplying the levator is unaffected, the other branches may be torn as there is no mobility of the ball.

6. Lang (*Trans. Ophth. Soc.*, vol. iv., p. 41) saw the following case: A boy of thirteen was knocked down in the street by a wagon and received a cut in the right brow, which was sutured. For twelve hours he had severe hemorrhage from the nose. When the swelling of the lids passed off, the right eye was seen to be sunken in the orbit. One month later there was a non-adherent cicatrix in the outer two-thirds of the brow. The palpebral fissure was 4 *mm* shorter than the left. Mobility of the eye diminished in every direction, particularly inward. The ball was dislocated slightly downward. The right cornea lay 8 *mm* behind the level of the left. Doubtful anæsthesia of the right cheek and forehead. No apparent alteration in the bony wall of the orbit. No pain on pressure. Lang's probable explanation is that the trauma caused a fracture or depression of a portion of the orbital wall, and the orbital fat is not sufficient in quantity to fill the enlarged post-ocular cavity, so that the ball sinks in from atmospheric pressure.

7. Tweedy (*Arch. für Ophth.*, xiii., 2, p. 457) saw a case similar to that of von Becker. The horn of a cow caused a perforation of the floor of the orbit which passed into the antrum. The eye being blind was excised. There were numerous adhesions. The fracture of the superior maxilla must have been very extensive, as for a time the ability to chew on the injured side was lost, and the teeth were very painful.

8. Langenbeck (*Arch. für Ophth.*, xiii., 2, 457) saw a similar case. A railway workman was struck on the right half of the

face by a locomotive. The upper lid was torn vertically and horizontally, and detached from the orbital margin. A deep wound extends vertically from the inner angle of the eye through the cheek to the upper lip. Through this wound the sound passes into the antrum. No eyeball can be found in the orbit. In its place is a bluish-black, soft, pulsating vesicle. It was supposed that the greater portion of the eye had been torn out, and that the blue pulsating mass represented the choroid. When the swelling had grown less eight days later, the ball was seen to be projecting through a defect in the floor of the orbit into the antrum. When replaced in position the ball was found to be uninjured and the vision normal. Four months later an ulcer appeared in the cornea, which finally led to phthisis bulbi.

9. Nagel (cited in *Graefe-Saemisch*, vol. vi., p. 507) observed a case in which the root of the nose and the inner half of the left lower orbital margin had been injured by the kick of a horse, and enophthalmus had developed. The ball was depressed 3 *mm* and sunken 2–3 *mm*.

10. Schapringer (*New York Medic. Monatsschr.*, June, 1890). A girl of seven fell against an iron grating. She did not lose consciousness but was very dizzy. No hemorrhage from nose or ear. Two hours later her mother noticed a drooping of the right upper lid and a retraction of the ball. The right cheek was ecchymotic.

The right upper lid droops covering more than half the pupil. The lid rises with the cornea in upward vision. The right eye lies 2 *mm* deeper than the left. The tension of the right eye is decreased. Motility normal. No disturbances of sensibility. Schapringer assumes, in explanation of the three symptoms, ptosis, enophthalmus, and hypotony, an affection of the sympathetic nerve due to bruising or hemorrhage. Three days after the injury, all the symptoms had disappeared.

11. Löw (Inaug. Dissert., Berlin, 1890). A man of forty-three was kicked in the left eye by a horse, and lay unconscious for two days. Six days later the lids could be opened and he discovered that he could not see. A sensitive scar extended from the inner angle of the lids upward to the orbital margin. The left eye lay 6 *mm* deeper in the orbit than the right. The infraorbital margin showed a deep depression at the junction of the middle and outer thirds. The mobility of the ball was normal inward, restricted upward and downward, and wanting outward.

The optic nerve was atrophic. Löw supposed that there had been a cicatricial contraction of the orbital cellular tissue and probably a partial cicatricial adhesion of the ball.

12. The first of my cases was seen in Prof. Fuchs' clinic. A man of forty-two was kicked in the right eye by a horse. He fell unconscious, bled, and vomited, but two hours later came to. A surgeon sutured two wounds. Eight days later the swelling was less, and when the eye was opened the patient found that he could not see well with it. There was no pain, but a "woolly feeling" in the eye. The retraction of the ball was noticeable ten to twelve days after the injury. Five months later when examined a depressed but not adherent cicatrix 3 *cm* long was seen running obliquely through the brow at the supra-orbital foramen. There was a corresponding bony defect. 3 *mm* outward from the outer commissure a linear non-adherent cicatrix 12 *mm* long runs downward and outward. At the upper end of this cicatrix is a small shallow depression in the orbital margin. The finger could be passed deep into the orbit and no evidence

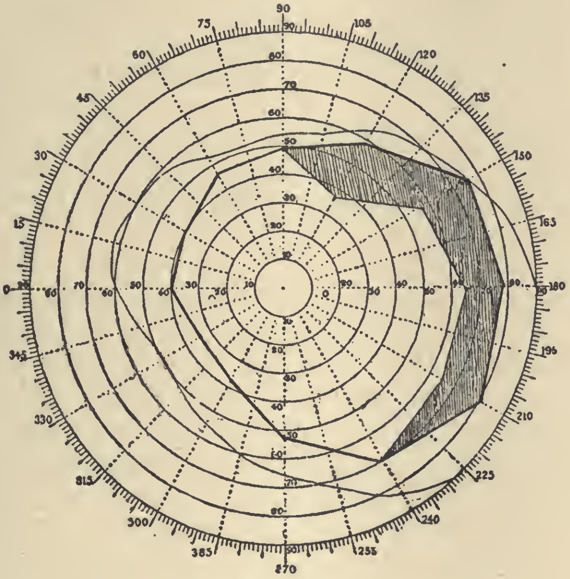

FIG. 1.

Field for white; shaded portion represents a zone of diminished visual acuity.

of fracture or depression was found. No portion of the orbital wall was sensitive to pressure.

There is slight ptosis. The palpebral fissure is 3 *mm* narrower than the left, and 4 *mm* shorter. The right ball lies 7.4 *mm* deeper than the left, and 2 *mm* lower. Elevation of the ball and lid restricted. Iridodialysis upward and outward, pupil irresponsive. $V = \frac{6}{36}$ not improved. Probably paralysis of accommodation. Patient could not read. The disc showed a post-neuritic atrophy. Visual field and color fields show a moderate concentric contraction. To the temporal side a relative scotoma.

13. My second case was a fifteen-year-old Alpine guide, who a month before had fallen ten feet, striking the left side of the face against a large stone. He did not become unconscious. Eight days later retraction of the left eye was noticed. No pain, vision normal. The left eye lies 3 *mm* deeper than the right, the upper lid droops but can be promptly elevated. No restriction of mobility ; no diplopia.

If we now arrange these thirteen cases in groups according to the degree of enophthalmus, the case of Schapringer will come first. Here there was a transitory enophthalmus of 2 *mm* appearing two hours after the injury, hypotony, and sympathetic ptosis. The enophthalmus according to Schapringer was due to a paralysis of Müller's orbital muscle from a lesion of the sympathetic.

There is no doubt but that a vascular spasm in the retrobulbar tissue, by decreasing the bulk of this tissue, may cause a transitory enophthalmus of varying degree. A traumatic irritation of the sympathetic vaso-motor fibres in the retrobulbar tissue would explain the slight and transitory enophthalmus in Schapringer's case. The hypotony is in accord with this explanation, and the ptosis may be considered a purely mechanical consequence of the enophthalmus.

In the second group would be the cases of Himly, Nieden, Gessner, Nagel, my two cases, and with some reserve the cases of Lang and Löw also. In these cases, some time after a more or less intense contusion of the ocular region, a considerable degree of enophthalmus was observed, which was permanent.

The cause of the enophthalmus, surely in most of these cases and probably in all, is an atrophy of the retrobulbar cellular tissue. Cicatricial contraction of the retrobulbar tissue, paralysis of the orbital muscle, and fracture of the trochlea, are not rational explanations. In Nieden's case we have a neurotic atrophy of the cellular tissue, and also in my first case. Here the symptoms were rupture of the skin, injury of the orbital wall, with corresponding non-adherent cicatrix. No marked pain, excessive enophthalmus after twelve days, ptosis, restricted mobility upward. $V = \frac{}{36}$, neuro-retinitis, and paræsthesia which also indicates a trophic neurotic disturbance.

Gessner's three cases cannot be explained as having been caused by orbital periostitis and phlegmon.

Löw's case was not due to cicatricial contraction of the cellular tissue, but to cicatricial adhesions of the ball itself.

While it is fairly certain that the enophthalmus coming on shortly after contusions in the region of the eye is due to diminution in the bulk of the orbital tissues from atrophy, the causal connection between this affection and the trauma is not clear. According to analogy we should suppose the atrophy of the orbital tissues to be due to a lesion of a nerve centre or tract, and particularly of the sympathetic or of the trigeminus. In neurotic atrophy of half of the face we have a picture similar to that seen in traumatic enophthalmus.

Further observations will be required to prove the correctness of my theory of traumatic enophthalmus. Even if in some cases there be found a cicatricial retraction of the ball or a depression in the orbital wall, the theory may still account for the majority of the cases.

After the manuscript of this paper had left my hands, a paper appeared by E. Heese "On the Influence of the Sympathetic on the Eye," etc., (*Archiv für die gesammte Physiologie*), vol. 52, p. 535, in which is given the experimental proof of my views. The following extracts are of interest.

"In the rabbit, irritation of the sympathetic produces a retraction of the eye. Cutting the sympathetic leads to a slight protrusion of the ball."

"In the cat and dog immediately after irritation there is a marked protrusion followed by retraction."

"In the newly killed rabbit the contrary condition to that observed in life is seen. Sympathetic irritation causes a slight protrusion. The different conditions of vascular tonus and the corresponding varying amount of blood in the orbit must influence the position of the ball."

"There are two forces governing the position of the ball; one is the state of contraction of the vessels with the consequent varying amount of blood in the orbit, and the other is the condition of the musculus orbitalis."

THE MEDICO-ELECTRIC EYE-BATH IN THE TREATMENT OF SCLERITIS AND EPISCLERITIS.

By Dr. JOSEPH NORSA, of Rome.

Translated by Dr. J. M. Mills, of New York.

SCLERITIS and episcleritis are found to be not infrequent accompaniments of gout and rheumatism, as well as of syphilis.

The chronic nature of this disease is well known, as is also the fact that, even with the most attentive and rational treatment, only a partial or temporary improvement is obtained, as the disease has a tendency to relapse, particularly in the part first affected, and also readily extends to the rest of the membrane.

It has been observed, in most instances, that the movement of the muscles of the eye is extremely painful. The inflammation of the sclera is indicated by sensitiveness to light, tearing, swelling of the tissues, and considerable capillary injection. The cells of the sclera become infiltrated, thereby causing the development of the capillary vessels, which serve, to a certain extent, to hasten the absorption of the exudation (Galezowski). The sequel, at times, is atrophy of the physiological elements, with more or less thinning of the sclera. Though the inflammation itself may not be severe, still at times it produces complications in the other membranes of the eye, such as keratitis, iritis, or choroiditis. The latter secondary affections are usually observed in syphilitic, scrofulous, or cachectic individuals.

As regards the treatment of this disease, improvement has been obtained from the use of atropine or cocaine or fomentations with lukewarm aromatic water, by scarification of the episcleral swelling (Adamück), or by deep incisions into the sclera (Darier), by scraping of the diseased scleral tissue, but especially by applying the steam-douche, for twenty minutes, two or three times daily, by massage of the eye if the healing is sluggish (Pagenstecher), and by injection of pilocarpin (De Wecker), and of sublimate solution (1:5000) into the scleral tissue (Snellen).[1]

At the same time it is, of course, necessary to prescribe internal treatment adapted to the general malady, of which the scleral affection is only a local manifestation. Therefore mercury and the iodine preparations are beneficial in episcleritis of syphilitic origin, whereas sulphate of quinine, colchicum, salicylate of lithium (Dufour, Panas[2]), and diaphoretics or mineral waters containing iodine, are useful in rheumatic and gouty scleritis and episcleritis. Frequently, however, these remedies are unable to limit the duration of the disease or to prevent a relapse. The cause of this, in my opinion, is that the local application is too superficial, and consequently only produces a transitory effect upon the membrane; and also that the internal treatment, entrusted to the circulation, operates only imperfectly and does not always reach the seat of the disease in the eye.

In order to overcome the difficulties previously met with in the treatment of this disease, I have endeavored to avail myself of past experience (in which, however, the internal treatment acted too slowly and imperfectly), by effecting a direct absorption of the medicament into the scleral tissue. This end has been attained by employing a remedy very useful in many other eye affections, namely, electricity. Acting upon the theory that the galvanic current has cataphoric power, and, at the same time, assists the absorption of the exudation by means of its catalytic properties, we made a number of experiments in severe, mild, and relapsing scleritis and episcleritis, in order to ascertain if this current, by transferring the proper medicated solution to the eye, could not effect a permanent and quicker improvement than could previously be obtained by the usual therapeutic measures. The method chosen for applying the electric treatment was the lukewarm eye-bath and the fluid was a 1–2 per cent. solution of salicylate of lithium. We were induced to try this treatment by the brilliant results of Dr. Denti[1] (and also my own[2]) in the treatment of other eye affections, particularly of the optic nerve, by means of the simple hydro-electric bath. We mention three cases, from among the many treated, as they had been of long duration and had resisted all other therapeutic measures, and therefore afforded a good opportunity of testing the efficiency of the treatment.

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[1] Prof. Snellen, *Ophth. Soc. Un. Kingdom*, Nov. 14, 1889.

[2] *Congrès d'Ophtalmologie de Paris*, 1888.

The method of using the eye-bath and the manner in which it works are as follows: A two-litre glass vessel, filled with a lukewarm 1–2 per cent. solution of salicylate of lithium, is placed two metres above the head of the patient. This reservoir communicates, by means of a rubber tube, with an ordinary eye-glass; at the bottom there is a perforation, through which a metal tube is passed. The outer end of this is fastened to the rubber tube, the inner end projects about ½ centimetre above the opening of the eye-glass. A small stop-cock placed on the metal pipe serves to connect or disconnect, as desired, with the water reservoir. There is also an opening in the side of the vessel provided with a stop-cock, in order to let off the water. Then, finally, we require an electric apparatus, preferably with a galvanometer, for developing a constant current; also a myriamperometer is desirable in order to regulate the exact strength of the current. One electrode communicating with the metallic plate, properly covered and dampened with salt water, is laid upon the cervical sympathetic, while the other is connected with a small screw on the metal covering of the eye-glass. It is immaterial whether the positive or the negative pole is placed on the eye or glass. This can be regulated by the sensitiveness of the patient to the one or the other. The electric bath is applied to each eye for about five minutes, and it is unnecessary to instil cocaine beforehand, as even nervous and feeble patients can bear it easily. This treatment can be repeated every day, as the hyperæmia of the conjunctiva, and especially that of the ball, after this treatment disappears, at the longest, in two hours. The patient experiences only a mild and easily borne sticking sensation of short duration.

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[1] Dr. Denti, *Saggio di Idro-Elettro-Terapia Oculare*, Milano, 1885.

[2] Dr. Norsa, *Un Biennio di Clinica Oculistica*, Roma, 1889.

[The report of three cases cured by the described procedure is omitted in the translation, for want of space. H. K.]

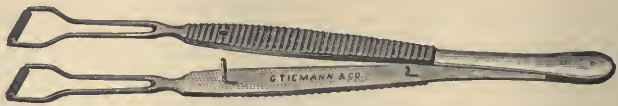
FURTHER COMMUNICATION ON THE TREATMENT OF TRACHOMA.

By H. KNAPP.

(*With one wood-cut.*)

IN the January number of 1892 of these ARCHIVES (vol. xxi. p. 119) I published my experience in the treatment of trachoma with the roller forceps, based on the observation of 114 successive cases. Since that time this treatment has been continued regularly in all suitable cases not only by myself, but by my associates at the N. Y. Ophthalmic and Aural Institute and the Eye Department of the Vanderbilt Clinic. Being familiar with this mode of treatment and its action and results, we have not so carefully recorded the cases as in the first series. Many of the ordinary follicular, uncomplicated kind, which, as usual, were promptly and permanently cured by one operation and a short after-treatment, have not been entered into the record book, but no cases were omitted that showed any abnormity either in their primary condition or in the course of healing, in particular such as were followed by relapses. After the first series (of 114 cases) from March to December 16, 1891, a second series of 86 cases (from the end of December, 1891, to the middle of January, 1893) is recorded. I now propose to report on these as well as on the relapses which occurred in the first series.

The *mode of operation* has remained the same as I described it in the above communication. After many trials Geo. Tiemann & Co. have furnished us with a satisfactory instrument which we have used for the last year. (See accompanying drawing.)



By a singular mistake, for which I cannot account, the length of the rolling cylinder has been misstated in my publication as being 20 to 25 *mm.* It never was more than 9 or 10. The mistake in the former publication is evident if we consider that 25 *mm* is one inch, which would make the instrument much too large. This error, which has also crept into the German translation of my paper, came to my notice only a few days ago when I read the article of Sydney Stephenson on "The Surgical Treatment of Trachoma" in the January number of the *Ophthalmic Review* (vol. xii., p. 2), where he says that he has modified the roller forceps in making the cylinder only 9–10 *mm* long, but 3 *mm* thick instead of 1–1.5 *mm.* In the instruments which I have used during the last year the cylinder is 2 to 2.50 *mm* thick. These cylinders turn very easily, and I do not doubt that those of 3 *mm* thickness turn still more readily, for the longer the lever the easier the revolution. Yet the thickness of the roller has its limits, for the bar has to be introduced between the lid and the eyeball, and the cornea should not be scratched.

In the new instruments the cylinder has a pivot at each end, fitting into a perforation at the ends of the legs of the stirrup. These legs are longer than in the former model and can be pulled apart so that the cylinder may be removed, cleansed, and sterilized after each operation. The creases in the roller have remained the same. Before use the roller is held into boiling water. I have never seen the cornea injured by the action of the roller, nor have I noticed any kind of infection from it. The instrument makers tell me that the demand for the forceps has been very large and steady, and almost no complaint has come to their notice.

In all severer cases of trachoma I use general anæsthesia, for the operation is tedious and *the success depends on its* *thoroughness.* All the soft trachomatous material should be pressed out from every portion of the conjunctiva in which it is deposited, visible or invisible. This can be done at the commissures and caruncle as well as in the tarsal and retro-tarsal portions. The roller must pass repeatedly over each place to secure the complete liberation of the trachoma substance. This substance being soft and gelatinous, it will come out by a pressure that does not interfere with the integrity of the cellular and fibrous elements of the conjunctiva. There is commonly free hemorrhage, which seems to be rather an advantage than a drawback as to the recovery. In no case have I seen sloughing or ulceration of the conjunctiva. Small ruptures of the surface of the conjunctiva occur, of course, whether we scarify this membrane or not. In the next days the posterior part of the palpebral conjunctiva is agglutinated to the reflex fold in many cases, and the advice is given to solve these adhesions with a probe. I have done this also at the beginning, but have found it of no importance, for these agglutinations disappear with the swelling and the fibrinous deposit of the conjunctiva. Where portions were cut off, adhesions and shortening were permanent.

The *indications* for the expression treatment are contained in the following sentence: *Expression is indicated only where trachomatous substance can be pressed out.*

In the *first place* are those cases in which spawnlike granulations are deposited in the conjunctiva without inflammatory irritation, the cases of *pure, non-inflammatory, follicular trachoma:* They are frequent in New York, but seem to be rare in other places, as would appear from a case observed at the University Eye Clinic of Berlin, described and depicted by Dr. R. Greeff, under the name of pseudotrachoma, which ended in spontaneous recovery. Dr. Greeff's description is identical with what I see in New York every week. This variety of trachoma is not infrequently limited to one eye, and I doubt very much whether it is contagious. I am inclined to consider it as an analogue of the adenoid or follicular hypertrophies of the naso-pharynx. They occur, as the latter, mostly in youth, rarely under five years or over twenty. I have no experience of their spontaneous disappearance without producing atrophy of the conjunctiva, but do not doubt it. Expression cures the great majority of them without any other treatment, but it alone does not cure them all. A small number return with relapses, usually mild ones, which are speedily cured by another expression. A few are made worse by expression, *i. e.*, the apparently pure, non-irritative, follicular trachoma is, by the mechanical treatment, converted into the inflammatory form of trachoma. The mucous membrane swells, burns, pains, secretes, and in the course of weeks becomes again the seat of miliary or spawnlike granulations, just as we see this deposition occur in the course of acute catarrhal conjunctivitis. I have noticed five such cases. The primary treatment of this inordinate reaction should be—as in the period of reaction in every case of expression—purely antiphlogistic: bathing the lids with cold water and washing the conjunctival sac out with a mild antiseptic solution. When the reaction is over, and the conjunctiva remains swollen and uneven, the so-called papillary hypertrophy, nitrate of silver (one per cent. solution) is of advantage, and when the spawnlike granulations have developed, and the conjunctiva is not much swollen, the rolling should be repeated. Of late, I have mostly used the sulphate of copper crystal as after-treatment, until the conjunctiva was smooth and completely free from granulations.

The *second class of trachoma*, which may be designated as *secondary*, *consecutive*, *inflammatory*, *or complicated trachoma*, comprises those cases in which the deposition of granules is preceded, accompanied, or succeeded by some form of conjunctivitis, commonly catarrhal or blennorrhoic in its nature. These cases *are contagious* (perhaps from the microbes of the original or complicating conjunctivitis) and *destructive*, producing shrinkage of the conjunctiva and corneal ulceration. Mostly both eyes are affected. This vast class of cases, which are chronic, with a marked tendency to relapses, is not cured by expression alone, yet it is greatly benefited by it. As long as there is hyaline infiltration, either granular or diffuse, this should be pressed out. I scarify such eyelids rather deeply, press the liquid and soft material out, and rub a solution of bichloride of mercury, 1:500, into the tissue with a pellet of absorbent cotton, or a tooth-brush, the grattage of Darier and others. This treatment is based on mechanical and germicidal principles, according to generally accepted theories. The results have, of course, not been so brilliant as in the non-inflammatory, follicular trachoma, yet the treatment has abridged the recovery essentially, and in many cases, I think, also set a stop to the progressive destruction of conjunctival and corneal tissue. This surely is an immense advantage. I have not seen that corneal ulceration or pannus has been made worse by this kind of treatment. It is not infrequent to see the ulcerous or pannous cornea become somewhat more opaque during the period of reaction from the mechanical and caustic treatment, but the increase of the opacity disappeared quickly in all cases that have come under my notice, and the corneæ afterward became clearer than they were before the operation.

A *third form* of trachomatous disease, which I have seen on the upper lids only, and I would call *sclerosing trachoma*, are those tough excrescences which are most obstinate and when once fully developed resist all kinds of treatment. Cases which I have watched from the beginning show in their initial stage the ordinary, rather vascular, lid granules. The copper crystal does not affect them, or rather favors their growth. In the course of months and years they multiply and cover the upper tarsal and retrotarsal conjunctiva in the shape of irregular, hard, red excrescences, flattened on their surface by the pressure of the thickened and heavy lid. Some of them can be raised with a probe, when they exhibit a pedicle and a mushroom-like, often notched, and lobulated head. Cut off with scissors they feel tough, and show under the microscope an irregular structure of dense fibrous tissue surrounded with vascular epithelium. In their further course they become pale, and ultimately completely white. The everted lid looks like a section of a dense fibroma. The disease lasts years, has no great tendency to affect the cornea, resembles in a certain stage the pale, tessellated tarsal conjunctiva of Saemisch's spring catarrh, but never shows the circumcorneal thickening. Strong remedies make it worse; mild washes, in particular a 1:5000 solution of bichloride of mercury brushed over the inner surface of the upper lid five or six times daily, seem to do good. The disease may be, and as far as I know usually is, recovered from without great roughness of the conjunctiva or damage to the cornea.

I classify this affection among the trachoma group because its beginning, when I had an opportunity to observe it, is distinctly that of follicular trachoma. Its course, however, is characterized by an inordinate development of tough fibrous tissue, a fibrous degeneration of the granular substance. It is distinguished from the cicatricial form of trachoma by the want of atrophy. The tarsus, instead of being shrunken and curved, is thickened and hypertrophied, a regular keloid scar in appearance and microscopic structure. When once this fibrous degeneration has taken place, expression and grattage are of no service, if I may judge from the observation of a few cases, but expression is decidedly beneficial in the first stage. This has been demonstrated by a recent case which on account of its importance I beg leave here to detail.

Robert L., a seventeen-year-old lad, of Hoboken, came to me complaining of swelling and drooping of his left upper eyelid. He had no pain, no discharge, no discomfort in the use of his eye. The right eye was normal. On everting the left upper lid, the tarsal and retrotarsal portions were red and swollen. The retrotarsal fold in its inner two thirds was densely beset with small spawnlike granules, whereas the outer third showed several red, and irregular excrescences which projected over the adjacent tarsal conjunctiva. The whole tarsal conjunctiva was red and uneven. The lower lid was intact. I considered the case one of simple follicular trachoma in transition to become sclerotic. I cut the excrescences off and put them in Müller's fluid, and then pressed out the granulated and diffuse hyaline substance from the nasal side of the lid. The next day the inner surface of the lid was red and swollen, but perfectly smooth, and the patient felt well. The day after, there was more swelling, but no discomfort. On the third day there was swelling of the lid and conjunctiva, heat, pain, lachrymation, but no mucous or purulent secretion. The fourth day, the tarsal conjunctiva showed a number of yellowish, miliary infiltrations. The other symptoms the same. Cornea intact. I let him bathe the eye with cold water as often as this felt grateful. Then the swelling began to subside; I ordered bichloride of mercury 1:6000 to be brushed into the eye four times daily. The miliary infiltration disappeared without a trace, the swelling of the conjunctiva passed away, and four weeks after the operation the eye was as widely open as the other, the upper lid no longer swollen ; the inner surface, though still redder than normal, was perfectly smooth, without a trace of granulation. Where the excrescences had been cut off, there was a slight scar to which the posterior portion of the conjunctiva adhered.

In cases of cicatricial trachoma, *i. e.*, the end stage of the uncured cases, expression, or any other form of mechanical treatment, is no longer indicated. When there still is some swelling and a partial infiltration of the lids, scarification and impregnation of the conjunctiva and tarsus with stronger solutions of bichloride may be resorted to in order to terminate more quickly this excessively tedious disease.

Summing up the results of the treatment sketched above, they are as follows:

1. Rapid, perfect, and permanent recovery by expression alone, or expression followed by a short course of mild caustic treatment, takes place in the majority of cases. This refers chiefly to the cases of pure follicular trachoma.

2. Imperfect recovery, *i. e.*, disappearance of trachoma, but leaving more or less shrinkage of the conjunctiva, is the common issue of old, neglected cases of inflammatory trachoma.

3. Relapses occur of both simple and inflammatory trachoma. They have been recorded in ten cases of the first series, and in eight of the second. The majority of patients come back with a relapse after having felt comfortable and done nothing for their eyes many months after the operation. The relapses were mostly promptly cured by a second

expression; in a few cases a third was necessary. In two cases the steady after-treatment with the copper crystal did not prevent a relapse. They had been treated as out-patients and worked in a dusty atmosphere.

4. The operation itself has neither destroyed nor injured an eye.

In conclusion I may say that the mechanical treatment, with or without scarification and impregnation of the lid with corrosive sublimate, does not cure all cases of trachoma, but it benefits and cures the great majority, and always abridges the recovery. In rare instances it converts a simple trachoma temporarily into an inflammatory trachoma, but injures no case permanently.

A REPORT OF THE PROCEEDINGS OF THE TWENTY-SECOND MEETING OF THE HEIDELBERG OPHTHALMOLOGICAL SOCIETY, HELD AUGUST 8, 9, AND 10, 1892.

By Prof. KARL HORSTMANN.

Translated by CHARLES H. MAY, M.D., New York.

1. Uhthoff (Marburg).—*The Ocular Disturbances of Syphilis of the Brain.*

During the past nine or ten years, Uhthoff observed 100 cases of syphilis of the brain; autopsies were made in seventeen of these cases. Changes were found not only in the eyeballs, chiasma, and optic tracts, but also in the nuclei. The eyeballs presented gummous iritis, irido-choroiditis, and changes in the retinal blood-vessels; the optic nerves showed more or less interstitial neuritis with perineuritis and localized gummata. When the latter occur at the chiasma, symptoms of temporal hemianopsia are developed—Uhthoff saw such a case. Another case presented complete obliteration of the ophthalmic artery, producing unilateral optic-nerve atrophy. Among the ocular nerves, the motor oculi was affected most frequently—six times unilaterally, twice bilaterally. In two cases there was paralysis of the abducens, in three cases paralysis of the trigeminus, in two cases disturbances of smell, and in two cases disturbances of hearing.

Michel (Würzburg) and Sattler (Leipzig) took part in the discussion; the former believes that the vascular changes are primary in most cases.

2. Schirmer (Königsberg).—*Sympathetic Inflammation without Perforation of the Globe of the Eye Primarily Affected.*

Schirmer gave an abstract of a paper about to be published on a clinical study of the etiology of sympathetic inflammation following intraocular tumors and subconjunctival ruptures of the globe. Out of thirty cases found in literature, in which various authors attribute sympathetic ophthalmia to the existence of a tumor, twenty-seven do not stand the test of severe criticism ; in the other three cases there was marked irido-cyclitis in addition to sarcoma of the choroid. On this account, the reader of the paper attributes the sympathetic ophthalmia to the irido-cyclitis, and not to the sarcoma, and demonstrates that the inflammation cannot be caused by the tumor—the former being merely an accidental, genuine irido-cyclitis, or one produced by endogenous infection ; in both cases we should be very guarded in making the diagnosis of sympathetic ophthalmia, and we certainly ought not to consider the tumor as the primary cause. Twenty cases had been reported in which sympathetic inflammation was reported as following subconjunctival rupture of the globe ; only five of these were worthy of consideration. In all of the cases there was a severe irido-cyclitis, which could not have been the direct result of contusion, since healthy tissue will not become involved in progressive inflammation after a simple bruise. On the other hand, the form and the course of these cases were analogous to what is seen in infectious uveitis after perforating wounds. Schirmer considers this to be the etiology in these cases, and believes that microbes enter the eyeball either through minute lesions in the sclera, or that endogenous infection exists. The correctness of the Leber-Deutschmann theory and the improbability of the theory of purely nervous transmission are each strengthened by the fact that traction upon the ciliary nerves, so often seen, is not sufficient to cause sympathetic inflammation, the addition of infectious neuritis being necessary. He does not believe that the micrococci pyogenes are the active microbes, but thinks there are other unknown and hitherto undemonstrated species.

3. R. Greeff (Marburg).—*Investigations in Sympathetic Ophthalmia.*

Greeff gives the bacteriological examinations of nineteen specimens of optic nerves which had been exsected, partly on account of the occurrence of sympathetic inflammation, partly because such inflammation had been feared. It was impossible to demonstrate the existence of microbes in the nerve or its sheaths by the various methods of culture, by anærobic breeding, or by inoculation of the anterior chamber of rabbits' eyes. Experiments were also made by inoculating the vitreous of rabbits' eyes with putrid fluids, aspergillus fumigatus, staphylococcus pyogenes aureus, etc. In no case could transmission of microbes from one eye to the other by means of the optic nerve or its sheaths be demonstrated. It was only when general infection had occurred that microbes were found in the nerve or sheaths of the opposite eye,—in such cases the microbes having travelled by vascular routes. He claims that Deutschmann's experiments have not been confirmed, and hence Deutschmann's theory of migration cannot be regarded as proven.

In the discussion, Pflüger (Bern) remarked that the occurrence of sympathetic affections was accompanied by febrile manifestations. Schmidt-Rimpler (Göttingen) advised neurotomy of the optic and ciliary nerves, including the branches, to the insertions of the muscles. Uhthoff (Marburg) never found the same causative micro-organisms in bacteriological investigations of sympathetic ophthalmia. Leber (Heidelberg) thought the parasitic theory very probable, even though not yet proven.

4. Fischer (Dortmund).—*The Early Manifestations of Anchylostoma Duodenale in German Miners, and the Effect upon the Eye of the Anæmia Caused by the Parasite.*

The anchylostoma occurs in the intestine by hundreds; it fastens itself upon the walls and causes marked anæmia. The parasite does not occur in the eye, but retinal hemorrhages are observed as a result of the anæmia.

Samelsohn (Cologne) and Nieden (Bochum) took part in the discussion.

5. C. Hess (Leipzig).—*Filamentous Keratitis.*

There had been two theories concerning the nature of corneal filaments: the first regarded them as coagulation of fibrin from the cornea; the second, as coagula from the conjunctival sac. Hess demonstrates that the filaments consist essentially of more or less degenerated corneal epithelium. The disposition to the formation of these filaments is explained by a peculiar degenerative process in the epithelium; this process, which was partly unknown before, Hess describes more minutely.

Landolt (Paris) and Wicherkiewicz (Posen) observed filamentous keratitis in decrepit individuals. Samelsohn believes there are no cases of typical filamentous keratitis, regarding the filaments merely as accompanying manifestations. Leber opposes this view, and attributes the formation of filaments to rapid proliferation of epithelium; in this he was supported by Wagenmann (Heidelberg) and Sattler (Leipzig).

6. VALUDE (Paris).—*Contribution to the Study of Hemorrhagic Glaucoma.*

Valude examined four cases of hemorrhagic glaucoma; all suffered from arterio-sclerosis. The retinal vessels showed hyaline degeneration and perivasculitis. Optic-nerve excavation and obliteration of the iris-angle were not always present, but dilatation of the veins of the iris and ciliary bodies was constant. He believes glaucoma hemorrhagica to be due to an alteration of the retinal blood-vessels, secondary to a disease of the blood-vessels in general.

7. ELSCHNIG (Graz).—*Acute Retrobulbar Neuritis.*

Elschnig reports four cases of bilateral acute retrobulbar neuritis which were followed after days or weeks by acute myelitis, including encephalitis. One of the cases was subjected to post-mortem examination somewhat less than two months after the commencement of the optic neuritis, and thus the clinical diagnosis was confirmed. Acute retrobulbar neuritis begins with sudden blindness, and must be differentiated from the cases of sudden blindness with ischæmia of the retinal blood-vessels. In the former there is frequently pallor of the optic nerve and occasionally also intraocular neuritis if the retrobulbar inflammation extends to the globe. Anatomically, acute retrobulbar neuritis consists of a primary interstitial neuritis.

Uhthoff and Samelsohn took part in the discussion.

8. MICHEL (Würzburg).—*The Nerve-Fibres of the Optic Nerve and Retina.*

The axis cylinders of the nerve-fibres are connected at one point with cells and terminate in branches—terminal branches. From the axis cylinders a series of prolongations are given off—collateral branches. In the optic nerve and in the retina there are centrifugal and centripetal fibres. The terminal branches are found in the retina; they are connected with the fibres of nerve-cells, a certain amount of nourishment being given to the nerve-fibres in this manner. If one eye be enucleated in a pigeon, medullated nerve-fibres will be found on the operated side and in the optic tract, even after a considerable period; this points to centripetal and centrifugal transmission, and also to centripetal and centrifugal nourishment, the two being perfectly distinct.

Haab (Zurich) took part in the discussion.

9. Samelsohn (Cologne).—*Peripheral Amblyopia.*

10. Wilbrand (Hamburg).—*Disease of the Optic Nerve of Systemic Origin.*

11. E. Meyer (Paris).—*An Experimental and Clinical Contribution to Endogenous Infection of Old Prolapses of the Iris, and Protection against Ectogenous Infection.*

Meyer believes that clinical experience points to endogenous infection. In an eye which presented only corneal opacities, he observed the occurrence of herpes corneæ. In the other eye, which presented a cicatrized prolapse of the iris, opacities of the vitreous then developed. Subsequently the scar softened; hypopyon occurred and was cured by galvano-caustic treatment. This was a case of internal infection. To protect prolapses of the iris from external infection, Meyer covers them with conjunctival flaps.

12. Schweigger (Berlin).—*Correction of Myopia by Aphakia.*

Schweigger operated upon five cases—four children eight to fourteen years old, and a woman of thirty-four; all had myopia of more than 16 dioptries; he operated upon one eye, by discission, and then removed the swollen lens. Recovery was good in all cases. The optical effect of the aphakia was about 15 dioptries, but the acuteness of vision was not improved to any marked extent.

13. Pflüger (Bern).—*Operative Aphakia in Cases of Myopia of High Degree.*

Pflüger performed an extensive discission and removed the swollen lens substance with the lance-shaped knife. He operated in fifteen cases of myopia, varying from 12 to 18 dioptries. His results were good. Sattler (Leipzig), Landolt (Paris), and Michel are opposed to the operation; Wicherkiewicz (Posen), Thier (Aix-la-Chapelle), Samelsohn and Fick (Zurich) favor it.

14. Chibret (Clermond-Ferrand).—*A Study of Bilateral Paralysis of Accommodation; its Analogy to Hysterical Paralyses.*

Chibret observed thirty-four cases of bilateral paralysis of accommodation. The affection is not uncommon, and occurs most frequently in females under twenty (two thirds). In only two cases was it found in men. The range of accommodation was lessened from 2 to 4 dioptries. Acuteness of vision and refraction were almost always normal. In many cases the pupil did not respond to light. Duration of the affection was from one to four years. Locally, convex glasses (2–3 dioptries) and cold water and electricity were used.

15. WAGENMANN (Heidelberg).—*Observations on Unilateral Retinitis Hemorrhagica.*

Wagenmann investigated a case of retinitis hemorrhagica occurring in a man of sixty, who had arterial sclerosis and who had been attacked with sudden blindness. There were numerous retinal hemorrhages ; with the exception of one, all the arteries were occluded. Besides this, there was hemorrhagic infarction of the retina and multiple embolism of the arteries ; there was no thrombosis of the central veins, but dilatation of the retinal veins was found.

16. HESS (Leipzig).—*The Etiology of Striped Keratitis after Cataract Extractions.*

Hess shows that the dilatation of the corneal lymph-spaces, which has hitherto been regarded as the cause of striped keratitis, is merely an accidental occurrence. The striæ result from a wave-like condition—a sort of pleating of the deepest layers of the cornea ; this results from a faulty relation between the pressure in the vertical and the horizontal meridian caused by the incision in the cornea—hence a sort of compression of the cornea in the horizontal meridian. Hess was the first who succeeded in studying the striæ after experimental cataract extractions in rabbits.

17. SAMELSOHN (Cologne).—*A New Method of Operative Procedure in Symblepharon.*

18. SATTLER (Leipzig).—*Bacillus Panophthalmitis.*

Sattler found the bacillus pyocyaneus albus in a circumscribed collection of pus in the vitreous of a woman of sixty, suffering from panophthalmitis. After removal of the mycotic collections all inflammatory manifestations disappeared.

19. HAAB (Zurich).—*The Use of Strong Magnets.*

Haab places very strong magnets upon the surface of the eyeball to remove fragments of iron. In this manner these may be removed through the opening by which they entered. He always employed a large Ruhmkorff apparatus. He succeeded in three cases in which the fragments had remained in the eye for long periods and had penetrated through cornea and lens. In one case, in which the fragment had already become encapsulated in the retina, he did not succeed in removing it.

SYSTEMATIC REPORT ON THE PROGRESS OF OPHTHALMOLOGY DURING THE FIRST QUARTER OF THE YEAR 1892.

By Dr. ST. BERNHEIMER, in Vienna; Prof. HORSTMANN, in Berlin; and Dr. SILEX, in Berlin.

WITH THE CO-OPERATION OF

Dr. S. M. Burnett, Washington; Dr. Dantone, Rome; Prof. Hirschmann, Charkow; Dr. P. von Mittelstädt, Metz; Dr. Werner, Dublin; Dr. C. H. A. Westhoff, Amsterdam; Dr. Schiötz and Dr. Ole Bull, Christiania; Dr. Deus, Berlin. Dr. Herrnheiser, Prague; Dr. Sulzer, Geneva, and others.

Sections I.–XI. Translated by Dr. Ward A. Holden.

Sections I.–V. Reviewed by Dr. St. BERNHEIMER.

I.—GENERAL OPHTHALMOLOGICAL LITERATURE.

TEXT-BOOKS, MONOGRAPHS, AND TREATISES ON GENERAL, BIBLIOGRAPHICAL, AND HISTORICAL SUBJECTS. STATISTICAL REPORTS.

1. Gosetti. The eye operations performed in the ophthalmic department of the Venice Hospital. *Annali di Ottal.*, vol. xxi., 2, 3.

2. Massachusetts Charitable Eye and Ear Infirmary. Sixty-sixth annual report, 1891.

3. Baltimore Eye, Ear, and Throat Hospital. Fourteenth annual report, 1891.

4. Oppenheimer, H. S. The blind of New York City. *Trans. Amer. Ophth. Soc.*, 1891.

5. LAQUEUR. On eye clinics and their importance in ophthalmic instruction. An address at the dedication of the university eye clinic in Strassburg, Dec. 19, 1891. Trübner.

6. COHN. Examination of the eyes of the inmates of the Breslau Institute for the Deaf and Dumb. *Centralbl. f. Augenh.* and *Zeitschr. f. Schulgesundheitspf.*, No. 3.

7. COHN. Hand-book of the Hygiene of the Eyes. Part 2. Urban and Schwarzenberg, Vienna.

8. MAGNUS. Wall charts for ophthalmic instruction. Part 1. Diagnosis of ocular disturbances of central origin.

9. HOLT. MAINE EYE AND EAR INFIRMARY. Sixth annual report, 1891.

10. BROOKLYN EYE AND EAR HOSPITAL. Twenty-third annual report, 1891.

GOSETTI (1) performed 134 cataract operations in the years 1888–91, in the ophthalmic department of the Venice Hospital, which has 112 beds. In 130 cases done with a small superior flap and with iridectomy, 119 were entirely successful, and 6 required secondary operations. In 3 cases there were complications in the interior of the eye, and in 2 cases the eye was lost by suppuration. The author emphasizes the necessity of performing iridectomy. DANTONE.

In 1891, 11,926 new patients were treated at the MASSACHUSETTS CHARITABLE EYE AND EAR INFIRMARY (2). There were 136 cataract extractions done, with suppuration in 3 cases. Graefe's operation was done in 100 cases, simple extraction in 7.

BURNETT.

At the PRESBYTERIAN EYE, EAR, AND THROAT HOSPITAL in Baltimore (3) 7,364 eye cases were seen in 1891. Of the 132 cataract extractions done, 44 were with iridectomy, and 88 without.

OPPENHEIMER (4) examined officially for the city of New York 572 persons who had reported themselves blind, 226 of whom were native-born. The principal causes of blindness were found to be as follows: Optic nerve atrophy 27, blennorrhœa neonatorum 38, blennorrhœa virulenta 93, cataract 50, choroiditis and iritis 29, glaucoma 62, trachoma 23, cataract operation 65, injuries 62, injuries of the head 22, and sympathetic ophthalmia 46.

BURNETT.

At the MAINE EYE AND EAR INFIRMARY (9) there were treated, during 1891, 670 eye patients. A tabulated statement of the results of 29 cataract extractions with one failure is given, and a description of the new and commodious hospital building.

BURNETT.

At the BROOKLYN EYE AND EAR HOSPITAL (10) there were treated, in 1891, 6,349 eye patients. All eye operations 1,012. Extractions, simple, 2 ; with iridectomy, 28 ; in capsule, 2.

II.—GENERAL PATHOLOGY, DIAGNOSIS, AND THERAPY.

11. ANTONELLI. A contribution to the study of phthisical eyes. *Annali di Ottal.*, xx., 6, p. 471.

12. SGROSSO. A contribution to the morphology and structure of epibulbar tumors, with particular reference to the presence of psorospermiæ in and among the cells. *Annali di Ottal.*, vol. xxi., p. 3.

13. POTAPENKO. On the ætiology of the periodic eye inflammation or moon-blindness of the horse (ophthalmia periodica; irido-choroiditis recidiva; fluxion périodique of the French writers). *C. Mitwratsch*, 1892, No. 7.

14. GARNIER. On entarteritic changes in the ocular blood-vessels. *Centr. f. prakt. Augenh.*, Jan., 1892.

15. LEBER. On attenuated tuberculosis of the eye. *Ber. d. ophthal. Gesellsch.*, vol. xxi.

16. SATTLER. On bacillus ophthalmitis. *Ibid.*

17. SNELLEN, Jr. Retinal changes in naphthaline poisoning. Utrecht, 1892.

ANTONELLI (11) described in great detail the histological changes found in each tissue in a phthisical ball with beginning ossification in the shrunken and degenerated vitreous.

SGROSSO (12) gives a detailed microscopic description of sixteen epibulbar tumors removed by De Vincentiis and Morand. Three were sarcomata, one a melanoma, and twelve epitheliomata.

DANTONE.

According to SNELLEN, Jr. (17), naphthaline is absorbed from the intestinal tract, and is excreted by the kidneys. Local degenerations occur in the retina, and if its use be continued, eventually the entire retina may become affected. The degenerated retinal elements form a granular necrotic mass, which is absorbed. The pigment cells proliferate. In severe cases the pigment cells within the focus are destroyed, and the proliferation occurs only at the margins. The process is a necrobiosis of the retina, and not an exudation between the retina and vitreous, or pigment layer (Panas); nor a collection of leucocytes in the retina (Dor); nor a hemorrhage in the chorio-capillaris (Kolinski).

The formation of cataract is a secondary process. The first stage, that of opaque spiculæ near the equator, is due to changes in the osmotic relations in and about the lens. When the use of naphthaline is stopped, and the aqueous becomes normal, and the osmotic equilibrium is restored, the lens loses its opacities. The second stage, that of opacity of the posterior cortex, is due to the fact that the nutritive fluid is not so quickly renewed on the posterior surface of the lens as on the anterior, and therefore the naphthaline contained in it remains more constant there, and acts more vigorously upon the lens. WESTHOFF.

III.—INSTRUMENTS AND REMEDIES.

18. ANTONELLI. An optometer and sciascope. *Annali di Ottal.*, vol. xxi., 2–3.

19. STRAUB. Placido's keratoscope. *Weekblad van het Nederlandsch Tijdschr. v. Geneesk.*, part 1, p. 572.

20. STRAUB. An apparatus for determining the position of rest of the eyes, and for revealing insufficiency of convergence. *Ibid.*

21. JACKSON. Cocaine anæsthesia for enucleation of the eye. *Annals of Ophth. and Otol.*, Jan., 1892.

22. STEVENS, G. T. An instrument for measuring heterophoria. *N. Y. Med. Jour.*, Jan., 1892.

23. CHISOLM. The Japanese hot-box the best means of applying dry heat for the relief of ocular inflammations. *Annals of Ophth. and Otol.*, Jan., 1892.

24. RISLEY. A new apparatus for determining and measuring anomalies of the ocular muscles. *Trans. Amer. Ophth. Soc.*, 1891.

25. RISLEY. A note on hyoscyamin. *Ibid.*

26. KNAPP. Demonstration of a roller forceps, constructed according to the principle of the mangle, for pressing out trachomatous granulations. *Ibid.*

27. AUBERT. Demonstration of a binocular corneal microscope. *Report of 21st Meeting of Germ. Ophth. Soc.*, 1891.

28. SCHWEIGGER. An electric ophthalmoscope. *Ibid.*

29. RINDFLEISCH. A simple apparatus for the objective determination of refractive errors. *Klin. Monatsbl. f. Augenh.*, vol. xxx.

30. STILLING. The use of anilin dyes. *Deutsche med. Wochenschr.*, No. 10.

31. HEDDAEUS. A trial frame. *Klin. Monatsbl. f. Augenh.*, vol. xxx.

32. LANDOLT. Clinical observations on the abuse of mercury in the treatment of diseases of the eye. *Brit. Med. Jour.*, March 26th.

33. SMITH, PRIESTLEY. On the corneal reflex of the ophthalmoscope as a test of fixation and deviation. *Ophth. Review*, vol. xi., p. 37.

The sciascopy optometer of Antonelli (18) consists of a narrow plate 20 *cm* long with fourteen small perforations containing lenses. A sliding and reversible cross-piece with additional lenses makes it possible to obtain any combination of + or − lenses between 0.5 D and 19.5 D. DANTONE.

STRAUB (19) recommends Placido's keratoscope without a magnifying glass for determining irregular and regular astigmatism above 2.5 D. WESTHOFF.

STRAUB (20) fastens a small mirror to one end of a measure 1 *m* long, and a small rule to the other end of the tape. The patient is seated with his back to the light. The observer sits opposite him and holds the mirror against his own forehead, so that the patient can look into it. The mirror is then turned on its horizontal axis and the patient fixes a distant object. The observer then makes the ordinary test with the rule. In emmetropes and myopes he found a divergent position of rest in one half the cases, and parallel axes in the other half. In hyperopes, Stilling's position of rest was either divergent or convergent, rarely parallel. He found further that hyperopes with binocular vision, as well as emmetropes, have a divergent or parallel position of rest, and that the convergent position is almost always in hyperopes not having binocular vision. With fixation for a distance of 30–50 *cm* obtained by making a black dot on the patient's nose and having him observe its reflection in the mirror, he found that relative divergence is normal, and that marked convergence is rarely found except in hyperopes not having binocular vision. WESTHOFF.

JACKSON (21) enucleates eyes which are not hyperæmic, under the influence of cocaine. The solution is not injected into the tissues, but is simply applied on the surface as the operation proceeds. The pain is said to be but slight. BURNETT.

STEVENS (22). When a candle flame at a distance of 20 feet is observed through a 13. D lens, it appears as a round disc of light. If the lens be held before one eye while the other is left free, the image of the flame is seen in the centre of the disc in orthophoria, and out of the centre in heterophoria, its location in the latter case varying with the nature and the degree of the heterophoria. Stevens uses a lens of this strength, covered except at its optical centre, which prevents the prismatic displacement that appears when the lens is not centred. The apparatus is cheap, practical, and as accurate as any of the tests in which the apparatus is held near the eye. BURNETT.

CHISOLM (23) considers the Japanese hot-box, used for warming the hands, as a convenient means of applying dry heat to painful eyes suffering from iritis, glaucoma, and the like.

BURNETT.

RISLEY (24) exhibited a rotating prism previously described in the report of the society for 1889; and also a stand holding the prism, a Maddox rod, and test glasses for ametropia.

RISLEY (25) concludes from his studies in regard to the chemical constitution of hyoscyamin salts, that only the pure crystals should be used, that the solution prescribed should be neutral and prepared with only moderate heat, and finally that alkaline filter paper should not be employed. BURNETT.

In constructing forceps for the expression of trachoma granules, KNAPP (26) has followed the principle of the mangle, by which method the contents of the granules are forced out with a minimum amount of tearing of the tissues. He has used the instrument in a great number of cases with favorable results. This variety of forceps is particularly serviceable in cases of thick spawn-like granulations, which are in most instances cured at a single sitting. BURNETT.

STILLING (30) reviews the numerous papers written in the last two years, both favorable and unfavorable, regarding the employment of anilin, and holds to his original belief that pyoctanin, rightly used, cuts short suppuration. The objection of Liebreich that the agent is not a purely chemical one, has not been verified. The results of its application depend principally upon the manner of using it. The much better results that are observed in severe corneal affections with ulceration, and the poorer results got in corneal inflammations where the affected part is covered with a healthy layer, prove that the remedy is of value when it can have free access to the purulent parts, and an intense staining can take place.

LANDOLT (32) is convinced of the inefficacy of mercurial treatment in tabic optic-nerve atrophy, and in cases of choroiditis and chorio-retinitis with marked atrophic changes. WERNER.

PRIESTLEY SMITH (33) shows how the deviation of an eye may be determined by observing the corneal reflex of the ophthalmoscope in its relation to the pupil. This method is sufficient for judging the immediate effect of a tenotomy. WERNER.

IV.—ANATOMY.

34. NUEL. On the vascular supply of the choroid and the nutrition of the retina, particularly in the region of the fovea centralis. *Arch. d'Ophth.*, vol. xii., Feb.

NUEL (34) describes the vascular system of the choroid in its different segments, and considers Sattler's description too schematic. The best eyes for such studies are those which have been enucleated for foreign bodies in the anterior segment, before a plastic exudation has taken place. In such eyes the vessels are well filled and the interstitial œdema allows the ready separation of the individual layers. The following points may be mentioned particularly. Toward the ora serrata the larger vessels are fewer in number; toward the macula, on the contrary, they form an unbroken layer. In the layer of larger vessels the arteries predominate; in the layer of smaller vessels, the veins. The intervascular tissue is thicker near the inner surface of the choroid, and particularly so in the neighborhood of the macula. Small veins and capillaries are present near the macula in such number that the choroid is thicker here than in any other part. The arrangement of the vessels provides for the nutrition of the outer layers of the retina, and the fovea is nourished exclusively from this source. The choroidal vessels thus serve the photochemical function of the retina, while the retinal vessels furnish its nutrition in a general sense. In pathological conditions of the macula, the vascular distribution plays an important rôle.

V.—PHYSIOLOGY.

35. Snell. On the importance of the examination of the eyes separately for defects of color-vision. *Brit. Med. Journ.*, Jan., 1892.

36. Gullstrand. On the simultaneous determination of refraction and visual acuity. *Hygiea-förhandl*, p. 73; *Nord. med. Arch.*, vol. xxiii., Stockholm.

37. Sulzer. The form of the human cornea and its influence on vision. Part 2. Influence of the cornea on vision. *Arch. d'Opht.*, vol. xii., No. 1.

38. Maklakoff. Contributions to the study of the influence of voltaic light on the skin. *Arch. d'Oph.*, vol. xii., No. 3.

39. Tscherning. Note on a hitherto unrecognized change which the lens undergoes in the act of accommodation. *Arch. d'Oph.*, vol. xii., No. 3.

40. Scimemi. On the conduction of the tears. *Annali di Ottal.*, vol. xxi., No. 2–3, p. 222.

41. Osio. The circulation of the intraocular fluids; nutrition of the vitreous. Critical examination of the recent studies on the subject. *Annali di Ottal.*, vol. xxi., No. 2–3, p. 168.

42. Matthiessen. The recent progress in our knowledge of the optical structure of the vertebrate eye. *Von Helmholtz Festschrift.* Leipsic, 1891.

43. Uhthoff. Study of the visual education of a child born blind, and successfully operated at the age of seven. *Ibidem.*

44. Knies. Contribution to the study of ocular estimation of size. *Ibidem.*

45. Engelmann. On electrical processes in the eye with reflex and direct irritation of the optic nerve. *Ibidem.*

46. König. On the values of spectral colors with different degrees of absolute intensity. *Ibidem.*

47. Fick. On fatigue and restoration of the retina. A reply. *Graefe's Archiv*, vol. xxxviii., 1.

48. Hebold. Decussation of the optic-nerve fibres in man. *Ibidem.*

49. SCHNELLER. On the motions serving binocular vision. *Ibidem.*

50. DIMMER. On the reflex from the retinal vessels. *Report of 21st Meeting German Ophth. Soc.*, 1891.

51. DIMMER. The ophthalmoscopic retinal reflexes. *Ibidem.*

52. SACHS. The influence of colored lights on the size of the pupil. *Arch. f. d. gesammte Physiologie*, vol. lii.

53. SACHS, H. On optic after-images. *Centr. f. Nervenheilkunde*, vol. xv., 2.

SNELL (35) reports a case of unilateral green blindness without a defect in the visual field, and a second case with red blindness in one eye and incomplete green blindness in the other.

WERNER.

GULLSTRAND (36) shows that we may obtain much simpler relations for the visual acuity in different refractive conditions and in accommodation, by using either the angle whose vertex lies at the anterior principal point—the principal angle, or the angle whose vertex lies at the anterior focal point—the focal angle, in place of the visual angle usually employed, whose vertex lies at the anterior nodal point. SCHIÖTZ.

As was shown in the first part of SULZER'S (37) paper, the peripheric decrease in corneal curvature is not the same for equal distances from the point where the line of vision intersects the cornea. From which fact it follows: (1) that there being no astigmatism in the centre, the peripheric portions of the cornea are astigmatic; (2) that with central astigmatism of low degree, there is no peripheric astigmatism or there is astigmatism against the rule; (3) that with central astigmatism against the rule, the peripheric astigmatism is greater and also against the rule; (4) that with moderate or excessive central astigmatism there is a more excessive peripheric astigmatism. This relation holds for all cases excepting those in which there is no central astigmatism. As in the ordinary method of examination we do not compare the astigmatism found by central fixation with that of the corneal zone concerned in direct vision, we may explain the discrepancy between the subjective and the objective astigmatism by this dissymmetry of the cornea, without having recourse to a lenticular astigmatism, which, until demonstrated by direct measurement, Sulzer will not accept. The location of the pupil, whose centre lies on an average 5° to the temporal side of the point where the line of vision intersects the cornea, and still more the artificial dilatation of the pupil, have a marked influence on the degree of subjective astigmatism. An ordinary cylindrical glass can only correct the astigmatism of a particular segment of the cornea, and will be of the greater benefit the less dissymmetry there is of the cornea. v. MITTLESTÄDT.

MAKLAKOFF (38) studied the action of the electric light on the eye and the skin, and devoted particular attention to the agents which prevent the injurious effect of the actinic rays. The best of these agents are quinia solutions and red or yellow varnish. When the skin was pencilled with one of these, the light had no effect on it, but pencilling with green or blue varnish or with glycerin, in similar conditions, did not prevent, but rather favored the production of the well-known signs of insolation. In Maklakoff's opinion it is the terminations of the vasomotor nerves and the walls of the capillaries, which, in a manner not yet understood, are affected by the actinic rays, and produce the changes which are so sharply localized in the regions exposed to the light. v. MITTELSTÄDT.

TSCHERNING (39) studied the changes of form in the lens in the act of accommodation by means of his ophthalmo-phakometer, and found that the Purkinje images are displaced upward, a phenomenon which can only be explained by supposing that toward the end of the act of accommodation the lens is displaced downward, thus producing a more accurate centring of the optical apparatus. v. MITTELSTÄDT.

SCIMEMI (40) made a number of experiments with syphons and capillary tubes, and also tried in cases of lachrymal fistula and normally functionating lachrymal apparatus to suck the tears through the lachrymal canaliculi. He concludes that the lachrymal sac is always at least half filled with fluid. The tears pass into the sac by capillary attraction and by aspiration of the sac itself, which is dilated before and after the closure of the lids by the lachrymal muscles. This dilatation stands in direct relation to the muscular contraction. It is weakest in the simple closure of the lids, more marked in firm closure of the lids, and reaches its maximum when the lids are pressed together. The tears flow down into the nose from the action of gravity, aided by the elasticity of the walls of the sac. DANTONE.

OSIO (41) speaks in detail of the gradual development of our knowledge concerning the circulation of the intraocular fluids, their source, their course in the interior of the eye, and their exits; he dwells on the influence exerted on their circulation by the blood, the nervous system, the accommodation, by pathological changes in the eye, paracentesis of the cornea and iridectomy, and finally by the local application of remedies. The experiments and opinions of many authors are collected and compared. In conclusion, the author collates the present views on the nutrition of the vitreous. DANTONE.

MATTHIESSEN (42) has with great care collected the scattered facts which are known in regard to the optical structure and the fundamental principles of the dioptrics of the vertebrate eye, and chiefly those concerning the refractive index of the ocular media, and the curvature and position of the refracting surfaces. For the most part only a few individuals of a species have been examined, so that the result cannot be considered to be unconditionally correct for all.

Each medium is considered in turn, and in general tables the values for the different species are compared. The metric and theoretic results of these comparisons are applied to the dioptrics of the enlarged eye. (BLAUWAL).

In UHTHOFF'S (43) blind-born, seven-year-old patient, an iridectomy upward was made in each eye, followed by an iridectomy downward. The shrunken cataract was removed from the right eye, but in the left a sufficiently large clear space was obtained by the second iridectomy. Observations of the patient were made for three months. Before and immediately after the operation the boy was quiet and apathetic, a change in his entire psychical condition being only observed much later.

KNIES (44) reports a series of interesting experiments designed for the purpose of studying the peculiar relations in the matter of sense memory and ocular estimation of size.

ENGELMANN (45) by new experiments sought to confirm the theory that there are both centripetally and centrifugally conducting optic-nerve fibres. Experiments were made first on the reflex irritation of the optic nerve, both by light and by chemical agents, on curarized frogs. To avoid possible deviations of the current, experiments were also made on the bare skull. The results of the experiments were positive. To prove that there had been no indirect irritation, the experiments were repeated after cutting the optic nerve. In the latter instances the result was negative or doubtful.

In a second series of experiments, light was avoided and chemical irritation with crystals of sod. chlor. was found to produce a positive result. When the chiasm was cut off from the brain there was no result.

The experiments on direct stimulation of the optic nerve were also made with both light and chemical agents. The centre of the cornea was employed, ¾ *mm* from the nerve entrance. The results were always positive. In order to exclude simultaneous irritation of the retina, the cut end of the optic nerve was also irritated with salt crystals, with positive effect.

König (46) undertook to measure and compare the values (luminous intensities) of the spectral colors with different degrees of actual intensity. With differences of intensity both the curves of the aperature breadth and the curves of the values changed their form.

Sections VI.–XI. Reviewed by Prof. HORSTMANN.

VI.—ERRORS OF REFRACTION AND ACCOMMODATION.

54. Batten, R. D. Myopia the result of constitutional disease. *Ophth. Rev.*, vol. xi., 1, 1892.

55. Fukala. On the cause of the increase in visual acuity in aphakic eyes which have been highly myopic. *Berlin. klin. Wochenschr.*, No. 23, 1892.

56. Fukala. The injurious influence of the accommodation on myopia. *Berl. Klin. Wochenschr.*, No. 23, 1892.

57. Landsberg. A peculiar employment of convex glasses in excessive hyperopia. *Klin. Monatsbl f. Augenh.*, xxx., p. 187.

58. Harlan. A further note on the use of toric lenses in astigmatism. *Trans. Amer. Ophth. Soc.*, 1891.

59. Walton, G. L. and Carter, C. F. Over-exertion of the eyes and headache. *Med. News*, March 19, 1892.

60. Theobald. Subnormal accommodative power in young persons a not unusual cause of asthenopia. *Trans. Amer. Ophth. Soc.*, 1891.

61. De Schweinitz. Remarks on asthenopia and intra-nasal disease. *Med. News*, Apr. 2, 1892.

62. Gould. Severe "common cold," due to reflexes from the eye. *Med. News*, March 12, 1892.

63. ROOSA. Astigmatism, its relative importance in asthenopia due to errors of refraction. *Med. Rec.*, March 26, 1892.

64. CHENEY, F. E. Ocular headaches. *Boston Med. and Surg. Jour.*, Jan. 7, 1892.

65. DERBY, HASKET. Macular changes as influencing the prognosis in advancing myopia. *Trans. Amer. Ophth. Soc.*, 1891.

BATTEN (54) is of the opinion that a high tension of the pulse and other vascular changes are common causes of myopia. Eleven cases are cited in support of this view, at the head of which stands myopia and chronic bronchitis in a child (!). WERNER.

FUKALA (55), who performed discission in a number of cases of high myopia, found an increase in visual acuity after the operation. The cause of this condition is referred to the fact that the second nodal point comes to lie farther from the retina, and therefore objects appear larger and nearer. He finds that the refraction of the myopic eye is decreased, on an average, 15.5 D in consequence of the aphakia. From this he concluded that in myopia of high degree, not only the increase in axial diameter of the eye, but also an increased refractive index of the lens, plays a rôle in the production of the myopia.

FUKALA (56) regards the doing away with accommodation in excessive myopia as an advantage, since myopia is increased by the raised tension which accommodation produces.

LANDSBERG (57) reported the case of an individual with congenital aphakia, who has $V = \frac{5}{30}$ with a $+ 8.$ D glass when it was held 6 *cm* from the eye. If the glass was held near the eye, vision was not improved by it.

HARLAN (58) reported a case in which he prescribed toric lenses, $- 5.5$ D $- 2.5$ D_c 65°, and $- 4.5$ D $- 4.$ D_c 130°. The glasses made by the optician were not toric, but had the ordinary form and were so uncomfortable that they could not be worn. They were exchanged for toric lenses, which were worn with comfort. BURNETT.

WALTON and CARTER (59) conclude from the study of nervous patients that a large percentage of cases of functional headache and particularly migraine are due to eye strain, and further that such symptoms occur even with normal visual acuity, so that when possible even the slightest error of refraction in such patients should be corrected. BURNETT.

THEOBALD (60) believes that when there is exophoria of more than 3° with fixation for 13", and orthophoria for distance, there is a weakness of accommodation. The weakest convex lens that gives the normal exophoria of 3° for near, should be prescribed for near work. BURNETT.

DE SCHWEINITZ (61) reports three cases of asthenopia with ametropia and heterophoria which were not improved by the correction of these errors, but were benefited by treatment of a nasal catarrh. BURNETT.

GOULD (62) gives a case of a strong man of forty-six, who contracts a severe cold whenever he goes without the glasses which correct his astigmatism and a part of his myopia, and the same thing occurred when he wore the glasses giving complete correction to his myopia, and when the cylinders were improperly set. BURNETT.

ROOSA (63) gives the histories of eleven cases to support his theme that asthenopia is due mainly not to hypermetropia or myopia or muscular insufficiency but to astigmatism ; and insists on the almost complete uselessness of paralyzing the accommodation when the ophthalmometer can be used. His experience would seem to be unique in these particulars. BURNETT.

CHENEY (64) relates three cases to support his theme that patients may suffer from ocular headache for years and have little if any local eye symptoms. The sight may be good and they may be able to use their eyes constantly for near work with little discomfort referable to the eyes and yet suffer from migraine which has its origin in a refractive trouble. BURNETT.

DERBY (65) has found that those cases of progressive myopia in which there was a pigment patch in the macular region never went on to separation of the retina even though the myopia and other changes in the interior of the ball were excessive. He relates a typical case in point of a patient who had been under observation for thirty years. He attributes the protection against detachment to a probable adhesion between the choroid and retina at that point. BURNETT.

VII.—LIDS.

66. STRAUB. Ophthalmia scrofulosa. *Weekblad Nederlandsch Tijdschr. v. Geneeskunde*, 1892, I, p. 664.

67. GURFINKEL. Malignant pustule of the eyelids. *Wjestnik Ophth.*, ix., I., p. 23.

68. HIRSCHBERG. Vaccine ulcer of the lid. *Centralbl. f. prakt. Augenheilk.*, 1892, p. 17.

69. WEYMANN. Fungus chalazicus. *Ophth. Rec.*, i., 9, p. 307.

70. HIRSCHBERG. On the formation of eyelashes. *Centralb. f. prakt. Augenheilk.*, 1892, p. 131.

71. STOEWER. Cysts of the upper lids. *Zehender's klin. Monatsbl.*, vol. xxx., p. 192.

72. HOHENBERGER. Pigmentary nævus of the lid with beginning sarcomatous degeneration. *Graefe's Archiv.*, vol. xxxviii., 2, p. 146.

73. DE SCHWEINITZ. Neuroma of the right upper lid and the neighboring temporal region. *Trans. Amer. Ophth. Soc.*, 1891.

74. VOSSIUS. Two cases of congenital, almost total immobility of the eyes and the upper lids. *Beiträge zur Augenheilk.*, 1892, part 5.

75. BIRNBACHER. A new operation for congenital ptosis. *Centralb. f. prakt. Augenheilk.*, 1892, p. 131.

76. GUIBERT. A case of double congenital entropium ; cure. *Arch. f. Opht.*, vol. xii., No. 2, p. 101.

77. FRANKE, E. Remarks on skin and mucous membrane transplantation in trichiasis operations. *Centralbl. f. prakt. Augenheilk.*, 1892, p. 34.

78. SCELLINGO. On plastic operations on the lids. *Boll. d. R. Accad. Med. di Roma*, vol. xviii., No. 1.

79. GIFFORD. On the use of Thiersch flaps in the treatment of trichiasis and entropium. *Amer. Journ. of Ophth.*, 1892, No. 1, p. 1.

80. THEOBALD. Two successful cases of skin transplantation by Thiersch's method. *Trans. Amer. Ophth. Soc.*, 1891.

81. ZINN. On reversal of the margin of the lid containing the eyelashes in trichiasis. *Wiener klin. Wochenschr.*, 1892, No. 21.

82. HARLAN. A modification of Dieffenbach's operation for restoration of the lower lid. *Trans. Amer. Ophth. Soc.*, 1891.

83. HANSELL. Pagenstecher's operation for entropium and distichiasis. *Med. News*, Feb. 13, 1892.

STRAUB (66) found the staphylococcus pyogenes aureus constantly in cultures from the fluid beneath blepharitis crusts and eczematous crusts on the ears and nose. WESTHOFF.

In Gurfinkel's (67) severe case of malignant pustule of the lid, the successful treatment consisted principally in local subcutaneous injections of two per cent. carbolic solution. The defect remaining in the lid was not large. Hirschmann.

Hirschberg (68) in a woman of thirty-eight observed a vaccine ulcer on the upper lid. She had been infected with the lymph of her one-year-old infant who had been vaccinated. The ulcer healed in twelve days.

Weymann (69) believes that a chalazion is a true granuloma of parasitic origin. He pictures and describes a fungus which he has found in the contents of the cyst. Burnett.

In order to obtain lashes in plastic operations of the upper lid, Hirschberg (70) carries the lower margin of the forehead flap lengthwise through the eyebrow, so that when the lower margin of the flap comes to form the free margin of the lid the hairs of the brow play the rôle of lashes.

Stoewer (71) gave an anatomical description of two cysts which were removed from the upper lids of a girl of sixteen. He believes them to have arisen from the glands of Krause.

Hohenberger (72) examined a pigment nævus with beginning sarcomatous degeneration, which extended over the upper and the lower lid of a girl of sixteen. Three years after the removal there was no sign of recurrence.

De Schweinitz's (73) case was that of a boy of twenty, who had a congenital tumor of the right eyelid causing pronounced ptosis, which extended also to the temporal region, giving rise to clinical appearances similar to the condition known as elephantiasis. Examination of the specimen, however, revealed, in addition to a general hypertrophy of the glandular tissue of the skin, some large masses which on cross-section appear as whorls of soft fibrous tissue containing in their centre more or less degenerated nerve-fibres. Excellent micro-photographs of the sections are given, as well as drawings showing the condition of the patient before and after the operation, which was, in result, fairly successful. Burnett.

Vossius (74) observed an almost total immobility of both eyes and of the upper lids in two brothers of healthy family. The visual acuity was considerably reduced in both. Vossius attributes the affection to a muscular anomaly.

In operating for ptosis, Birnbacher (75) makes an incision in the skin of the lid along the entire upper margin of the tarsus.

Three double sutures are passed through the margin of the tarsus and are then carried under the skin and are brought out in the brow and knotted. The loops of thread are left for 20–25 days, producing subcutaneous cicatrices between the brow and the tarsus. The lid may then be raised by the frontalis muscle.

GUIBERT (76) saw in a girl of three a congenital entropium of the lower lids, the margins of which were apparently thickened and without lashes. When the lids were everted the lashes were brought into view. The eyes showed no signs of irritation and the corneæ were clear. The lids were burned through to the conjunctiva in a line 2 *mm* from the lid margin and parallel to it, and on the following day the position of the lids was normal. The tarsal cartilage was wanting. The child's skull was asymmetrical. The mother was a tippler and phthisical; the father, sound.

V. MITTELSTÄDT.

For trichiasis, FRANKE (77) transplants skin flaps from the upper arm into the split intermarginal space. If mucous membrane is used, it is taken from the lower lip.

SCELLINGO (78) reports two successful plastic operations for cicatricial ectropium. Skin flaps were taken from the inner surface of the upper arm to cover the defect. DANTONE.

After splitting the lid as in the ordinary Jaesche-Arlt operation, GIFFORD (79) makes an incision in the skin containing the hairs at an angle of 45° at each end of the cut, extending $\frac{1}{2}$ *cm.* This allows of a considerable retraction of the detached skin, which is held in place by sutures, and the raw surfaces thus exposed he fills with grafts from the inner side of the forearm after Thiersch's method. He prefers these grafts to those from the lips, and in 28 cases none have failed in which it was given a fair trial. He shaves the graft from the skin with a broad razor. He has also modified v. Burow's operation of the undercutting of the tarsus, by filling in the opening with grafts from the lips.

BURNETT.

THEOBALD (80) has used skin-grafting after Thiersch's method in two cases which, after the lapse of months, seem to be successes. The grafts, which were taken from the inside of the forearm, all "took" except one, and that sloughed only at one part. Both were treated as out-patients and with no unusual antiseptic precautions. BURNETT.

The reversing of the tissue containing the eyelashes, which operation Stellwag performs for distichiasis and trichiasis, had the disadvantage that the lashes in time fell out of the atrophic follicles. ZINN (81) guards against this by cutting out a broader piece of skin, which, before the transplantation, is freed from all bits of tarsus and of a portion of the muscle, without injuring the hair follicles.

HARLAN (82) fills in the large exposed surfaces left in the malar surface by the sliding inward of the flap in Dieffenbach's operation, by a flap from the temporal region, which he slides downward. The result, he claims, is most satisfactory, the resulting deformity being rarely noticeable. BURNETT.

HANSELL (83) reports two successful operations for entropium by Pagenstecher's modification of Hotz's operation.

BURNETT.

VIII.—LACHRYMAL APPARATUS.

84. HEDDAEUS. On the so-called blennorrhœa of the lachrymal sac in the new-born. *Zehender's klin. Monatsbl.*, xxx., p. 81.

85. WEISS, L. Treatment of the lachrymal passages of the new-born. *Ibidem*, p. 238.

86. MERCANTI. A contribution to the etiology of dacryo-cystitis in the new-born. *Annali di Ottal.*, xxi., 2–3, p. 133.

87. GUAITA. A new operative procedure for the rapid treatment of dacryo-cystitis. *Annal. d'Ocul.*, cvii., p. 30 ; *Centralbl. f. prakt. Augenh.*, 1892, p. 5.

88. GIULINI. A case of small round-celled sarcoma of the lachrymal gland in each eye. *Munchener med. Wochensch.*, 1892, No. 6.

89. GOULD. A simple method of treating many cases of lachrymal obstruction. *N. Y. Med. Jour.*, June 4, 1892.

According to HEDDAEUS (84) the blennorrhœa of the lachrymal sac in infants is nothing but a stagnation of the physiological secretion of the tear passages caused by the mechanical stoppage of the nasal orifice of the lachrymal duct.

In the experience of WEISS, (85) simple digital expression of the contents of the lachrymal sac is often not sufficient in the new-born, and the repeated passage of conical sounds is indicated.

MERCANTI (86) in a two-day-old infant observed a tumor of the lachrymal sac, while no pathological change could be discovered in the eye or in the nasal passages. Cultures of the thick pale yellow pus showed a peculiar bacillus which after various culture and inoculation experiments, the author took to be a variety of the bacterium coli commune. The author assumed an infection at birth from the fæces of the mother. The infant recovered quickly with antiseptic treatment and continuous expression of the sac, and particularly after the twelfth day when the lachrymal bone seemed to be perforated and the pus discharged into the nasal cavity. DANTONE.

For the purpose of healing a dacryocystitis quickly, GUAITA (87) advises scraping the cavity of the lachrymal sac and introducing a canula of decalcified bone into the lachrymal duct which has been previously split.

GIULINI (88) in a man æt. seventy-seven, observed a tumor of the lachrymal gland in each eye. Both glands were extirpated and the tumor was found to be a small-celled sarcoma.

GOULD (89) recommends, in the treatment of many cases of dacryocystitis and lachrymal obstruction, frequent emptying of the sac, with massage, in preference to opening the canaliculus. Only in more obstinate cases does he advise the dividing of the sphincter of the punctum. BURNETT.

IX.—MUSCLES AND NERVES.

90. GRUENING. On the operative treatment of divergent squint. *N. Y. Med. Jour.*, March 12, 1892.

91. STEVENS. An examination of some of the means for the determination of heterophoria. *Ophthalmic Record*, Jan.-Feb., 1892.

92. STEVENS. Sudden attacks of diplopia. *Annals of Ophth. and Otol.*, Jan., 1892.

93. SAVAGE. Heterophoria, a safe line drawn between operative and non-operative cases. *Ophth. Rec.*, Jan.-Feb., 1892.

94. BURNETT, SWAN M. Contributions to the study of heterophoria and its relations to asthenopia, headache, and other nervous symptoms. *Trans. Amer. Ophth. Soc.*, 1891.

95. BOEDEKER. On a case of chronic progressive paralysis of the ocular muscles, in conjunction with toxic amblyopia. *Arch. f. Psych.*, xxiii., 2, p. 313.

96. FRANK. On ophthalmoplegia interior. *Vereinsblatt d. Pfälzer Aerzte*, 1892, p. 2.

97. Widmark. On ocular symptoms with trigeminus affections. *Nord. Ophthalm. Tidsk.*, ii., p. 63, Copenhagen, 1891.

98. Howe. Concerning muscular advancement. *Amer. Jour. of Ophth.*, May, 1892.

In absolute divergent squint not periodic, paretic, or secondary, Gruening (90) exposes the tendon of the externus in its whole extent and when the amount of the divergence is not more than 2 *mm*, simply divides the tendon at its attachment. When it exceeds that amount he divides it farther back from its attachment, in proportion to the degree of squint. If, for example, there is 5 *mm* divergence, he divides the tendon 5 *mm* from its attachment. He operates on both externi at the same time, drawing the eyes inward by means of sutures which are passed through the conjunctiva above the interni and are knotted over the nose.
Burnett.

Stevens (91) thinks that we cannot have too many methods for testing the balance of the ocular muscles and that all the proposed methods have a special value in certain cases. The deviation in exclusion including the parallax, while in some cases an invaluable test, is not a ready one and one not always available. The Maddox rod is useful and very convenient. The lens with a sptenopaïc opening which causes the image of the eye before which it is held to appear as a disc of diffused light, seems the best of all those which are used near the eye. The diplopia by a simple prism, especially if held close to the eye, is unsatisfactory. However, the phorometer is the test on which he relies principally for information, the other tests being auxiliary. Burnett.

Stevens (92) relates the histories of two cases which serve as the basis of some observations on sudden attacks of diplopia, and concludes that the occurrence of diplopia, without paralysis, in persons accustomed to single vision does not necessarily call for operative interference. In such cases the general condition of the patient must be gone over carefully, and the function of the two eyes as regards their muscular power tested separately and together. Burnett.

In heterophoria, Savage (93) considers that primarily all cases which show diplopia under the red-glass test are subjects for operation, and in a general way hyperphoria of 3° and exophoria or esophoria of 10° or more are also operative cases, and finally all cases even of low degrees, which are not benefited with prisms, should be operated on. Burnett.

BURNETT (94) reports six cases in which he had made tenotomies for heterophoria accompanied with severe asthenopia and headaches, one of hyperphoria, one of esophoria and four of exophoria. In all, the symptoms disappeared. All had been treated previously with prisms. BURNETT.

WIDMARK (97) discusses a series of cases having ocular symptoms with affections of the trigeminus. They showed pain in one or both eyes, with or without simultaneous headache. Often there was photophobia, lachrymation, and pain in the lids. The symptoms appeared most frequently with near work and artificial illumination. There is a feeling of oppression in the forehead and sensitiveness along the nerves. The treatment consists in massage of the sensitive points. SCHIÖTZ.

HOWE (98) has modified Wecker's forceps for holding the divided tendon in advancement, by making it much smaller and lighter so that it can be left to itself when it has once clasped the tendon. He uses the loop suture of Prince with some slight modifications. BURNETT.

X.—ORBIT AND NEIGHBORING CAVITIES.

99. HODGES, F. A case of tenonitis after influenza; excision. *Ophth. Rev.*, vol. xi., No. 124, p. 149.

100. USZYNSKI, A. On retrobulbar affections. *Zehender's klin. Monatsbl.*, vol. xxx., p. 110.

101. BORTHEN, L. Localized orbital abscess as a complication of influenza. *Norsk. Mag. f. Lagerid.*, 1891, No. 3, p. 203.

102. MILLIKEN. A case of partially bony tumor of the orbit; removal; recovery. *Trans. Amer. Ophth. Soc.*, 1891.

103. GAYET. On the osseous restoration of the margin of the orbit. *Arch. d'Opht.*, vol. xii., 4, p. 93.

In HODGES' (99) patient, chemosis and proptosis of the right eye appeared fourteen days after an attack of influenza. Incision had no effect. The eye was quite blind. The excision was difficult on account of the adhesions. These consisted of fibrous masses with numerous round cells, which surrounded the inferior portion of the eye. The ciliary body was also infiltrated with round cells. Besides this there was total detachment of the retina. WERNER.

USZYNSKI (100) reports a case of retrobulbar abscess which got well after incision.

Borthen (101) reports the case of a girl of fourteen in whom, after an attack of influenza, the right eyelids became œdematous, the ball prominent and immobile, and an abscess formed in the nasal portion of the orbit. Recovery after incision. Vision remained normal. Schiötz.

In Milliken's (102) case there was a hard tumor at the upper inner portion of the orbit pushing the ball outward, downward, and forward. This was first noticed at six years of age as a small tumor, which was operated on, but there had been a discharge ever since. On exposing it by an incision in the integument it was found to be hollow and contained a soft, fibrous material well organized, but no pus. The walls were cut away, the contents removed, and the cavity thoroughly cleansed and made aseptic. The external wound was closed after the orbital contents had been put in position. The wound healed nicely and there only remains some ptosis. Movements of the eye are limited ; there is diplopia and the nerve is whitish. The contents of the tumor were found to be sarcomatous. Burnett.

Gayet's (103) case was that of a young man who had been struck on the lower margin of the orbit with a piece of wood. There was ectropium of the lower lid produced by adherence of the lid to the depressed bone cicatrix at the inferior orbital margin. Gayet cut round the cutaneous cicatrix, loosened the skin of the lid with the periosteum and pushed it upward. The orbital margin, which now lay bare, was separated from the superior maxilla by boring a number of holes in a line convex upward with a drill, and filing through the remaining communications. The bony plate, which now was adherent only to the floor of the orbit, was pushed upward and held in its new position by three platinum clamps fastened into the superior maxilla, thus leaving a free opening into the maxillary antrum. The lid flap was then brought down and fastened. Recovery without fever or accident. Result very satisfactory. v. Mittelstädt.

XI.—CONJUNCTIVA, CORNEA, SCLERA, ANTERIOR CHAMBER.

104. Brisken. The prophylaxis of ophthalmia neonatorum. *Münch. med. Wochensch.*, No. 5, 1892.

105. v. Steinbüchel, R. The influence of gonorrhœa on the puerperal woman, and on the eye diseases of the new-born. *Wiener klin. Wochensch.*, Nos. 21, 22, 1892.

106. Wilson, F. M. On the use of vaseline in gonorrhœal conjunctivitis. *Trans. Amer. Ophth. Soc.*, 1891.

107. Panas. On the treatment of trachoma; with an historical sketch. *Arch. d'Opht.*, vol. xii., No. 6, p. 358.

108. Gerken. The trachoma question. *Wjest. Oph.*, vol. ix., No. 3, p. 197.

109. Darier. Surgical treatment of trachoma. *Arch. d'Opht.*, vol. xii., No. 2, p. 95.

110. Gerke, O. A case of croup of the conjunctiva, mouth, and nose. *Arch. f. Augenheilk.*, vol. xxiv., p. 305.

111. Kain, E. On the etiology of croupous conjunctivitis. *Wiener med. Wochenschr.*, No. 10, 1892.

112. Barnes, S. D. Mucous patch of the conjunctiva. *Amer. Journ. of Ophth.*, Feb., 1892.

113. Weymann, M. J. A case of fibro-lipoma of the conjunctiva. *Ophth. Record*, No. 1, 1892.

114. Shirley, I. A. Fatal hemorrhage in an infant after scarification of the conjunctiva. *N. Y. Med. Journ.*, Jan. 2, 1892.

115. Fuchs. On pterygium. *Græfe's Archiv.*, xxxviii., No. 2, p. 1.

116. Claiborne, J. H. The treatment of trachoma. *Ann. Oph. and Otol.*, Jan., 1892.

117. Wolfner, H. T. How to treat simple conjunctivitis and purulent ophthalmia. *Ann. Oph. and Otol.*, Jan., 1892.

In women who are seen at the beginning of labor, Brisken (104) advises the use of disinfecting washes in the vagina according to Kaltenbach's method, and the washing out the eyes of the newborn infant with distilled water; in women who first come under observation when labor is far advanced, Credé's method must also be employed. There is no means of protection against late infection.

V. Steinbüchel (105) examined the genital secretion of 338 pregnant women bacteriologically, and found positive evidences of gonorrhœa in 73. Six of the infants born of the 73 infected women suffered from ocular affections, of which 3 cases were virulent and 3 not. Of the total 313 infants born, 4 had virulent and 9 benign catarrhs. In the 4 cases of virulent catarrh, the gonococcus was found, yet only 3 cases were due to infection at birth. The greater part of the ocular affections were irritation catarrhs and slight inflammations, which were caused by the careless employment of Credé's method.

Wilson (106) has used introduction of vaseline under the lids as an adjuvant in treating purulent conjunctivitis, and with markedly good results. He considers it efficient by its cleansing powers primarily, though it possibly may have a curative one as well. Burnett.

Panas (107), after a short historical review of the treatment of granulations, gives his own treatment without advancing anything particularly new. v. Mittelstädt.

Gerken (108) in 1890 examined the eyes of all the inhabitants of the village of Lichterma. He considers the cause of trachoma to be the immediate inoculation by the transfer of the fresh secretion of trachomatous eyes from one subject to another. The trachoma begins with the formation of follicles. In a fourth of the cases the trachoma gets well of itself, leaving small cicatrices at the orbital margin of the tarsus, which do not injure the eye. Hirschmann.

Darier (109), after an experience of 130 cases in Abadie's clinic, recommends the surgical treatment of granular conjunctivitis. Under ether the lid is everted with a particular forceps, the conjunctiva scarified, then with a sharp spoon and small brush all morbid tissue is removed, and finally the entire surface is thoroughly washed with a 1:500 sublimate solution. After this ice compresses and bathing with 1:2000 sublimate solution. The lids must be everted daily, the conjunctiva cleaned with a sublimate solution, any adhesions loosened, and when there are still granules, the brushing must be repeated. The treatment lasts a month on the average. If the lids are not everted and cleaned daily, symblepharon may occur. In 10 cases an entropium had to be corrected. The cicatrices are not more marked than those following other methods of treatment. In many cases there is a fibrinous exudation on the conjunctiva and rarely corneal affections. If such have existed previously, they are favorably influenced by this treatment. v. Mittelstädt.

Gerke (110) observed in a soldier of twenty-one the appearance of typical croup of the conjunctiva, which later affected the mucous membrane of the mouth and nose. Inoculations of bits of the membrane in agar-agar, blood serum, and gelatine, produced cultures of double bacilli which stained best with methylin blue. Inoculations of these bacilli on the conjunctiva of rabbits and men produced a non-membranous conjunctivitis.

KAIN (111) had a similar result.

In a man with a history of syphilis, under BARNES' (112) care, a mucous patch was seen on the conjunctiva of the lower lid of the left eye, which extended in a few days to the conjunctiva of the globe. It disappeared under the use of black wash and proper internal treatment. BURNETT.

The tumor described and removed by WEYMANN (113) was on the outer side of the right eye over the external rectus muscle. It was congenital, but had been growing lately. The child was then six years old. It was 7 × 3 *mm* and 3 *mm* thick, and movable on the sclera. It was made up of fibrous bands whose interstices were filled with fat cells, but the greater part of the growth was fibrous. BURNETT.

SHIRLEY (114) relates that he had occasion to scarify freely the conjunctiva of an apparently healthy negro infant of two weeks for muco-purulent conjunctivitis, and that the hemorrhage that ensued went on, in spite of all efforts to control it, to a fatal issue.

BURNETT.

According to FUCHS (115) the pterygium develops from the pinguecula. It is covered with conjunctival epithelium, which may extend beyond its margins. Where the pterygium rests on the cornea, Bowman's membrane has mostly disappeared. But there are also changes in the corneal tissue in front of the anterior margin of the pterygium, consisting in the destruction of Bowman's membrane and in the loosening of the epithelium and the superficial lamellæ, proving that an affection of the cornea has preceded the development of the pterygium. The relation of the spreading margin of the pterygium to the cornea is not constant ; at times it pushes as a loose, vascular tissue between the superficial lamellæ, at times it consists of a dense sclerotic connective tissue resting upon the normal Bowman's membrane. The first relation is found in progressive pterygia, the second in stationary. Fuchs believes that a pinguecula causes nutritive changes in the cornea. The superficial lamellæ of the cornea become loosened and separated, and the connective tissue of the limbus grows in. Since the nutritive fluids flow from the marginal network to the centre of the cornea, the disease of the cornea extends in this direction, and, in consequence, the pterygium grows toward the centre.

CLAIBORNE (116) burns off the excessive granulations in trachoma with the actual cautery, and completes the reduction of the tissue by applications of the copper stick. The acute stage he treats with ice applications and mild antiseptic washes.

BURNETT.

In WOLFNER'S (117) opinion all strong medication is out of place in treating conjunctival inflammations. He treats acute cases as he would a coryza, viz., hot foot-bath, warm drinks, rest in bed, and a cooling lotion to the eyes. The same general principle applies to purulent conjunctivitis, except that the eye must be kept clean. He opposed all astringents, and only weak germicides should be used. BURNETT.

118. HESS. Contribution to the study of filamentous keratitis. *v. Graefe's Arch.*, vol. xxxviii.

119. GILLET DE GRANDMONT. The microbic nature of keratitis. *Arch. d'Opht.*, vol. xii., 3, p. 149.

120. WILLIAMS, R. On the treatment of spreading ulcer of the cornea with hypopyon. *Lancet*, Jan., 1892.

121. DE WECKER. Corneal antisepsis. *Arch. d'Opht.*, vol. xii., 4, p. 201.

122. SIMI. Macula of the cornea. *Boll. d'Ocul.*, vol. xiv., 4.

123. COLBURN, F. E. Keratitis bullosa. *Amer. Jour. of Ophth.*, No. 4, 1892, p. 101.

124. CAPEI. A rare case of grave bilateral ocular lesion from lymph stasis in the cornea. *Boll. d'Ocul.*, vol. xiv., 10.

125. ADAMÜCK, E. On the use of sutures in corneal wounds. *Wjest. Ophth.*, vol. ix., 1, p. 16.

126. SIMON, R. A case of corneal neoplasm. *Centrabl. f. prakt. Augenheilk.*, 1892, p. 193.

127. GULLSTRAND, A. A case of keratoconus with rhythmic pulsation of the cornea. *Nord. Ophth. Tidskrift.*, vol. iv., 3, p. 142.

In the cases of filamentous keratitis that HESS (118) examined, the corneal epithelium played an important part in the formation of the filaments. The development of these is probably favored by a peculiar affection of the epithelium. It is not impossible that, besides the epithelium, at times also subepithelial tissues take part in the formations, and fibrinous or mucous threads from the conjunctiva may adhere to the corneal filaments already formed.

Gillet de Grandmont (119) attributes the development of corneal ulcers to micro-organisms which enter from without through some solution of continuity. Inoculating bits of the floor of an ulcer on agar-agar, gave cultures of various microbes, principally staphylococci, whose re-inoculation again produced ulcers. v. Mittelstädt.

Williams (120) has obtained good results from the local application of quinine (4 gr.: ℥ j) in hypopyon ulcers. For paracentesis he prefers a radial incision in the sound part of the cornea. Werner.

According to de Wecker (121) most corneal diseases are of parasitic origin, and demand a corresponding treatment. The cause of the long course of the disease and the unsatisfactory results of treatment are due to the lack of a sufficient antisepsis. In order to bring active antiseptics as long as possible in contact with the affected spots, or to protect cautery wounds from a second infection, repeated instillations and a protecting bandage are not sufficient. De Wecker recommends his glass vessels, which may be laid on the anterior surface of the eyeball without causing irritation, and which may be used even in children. The antiseptic fluid is introduced through the central opening in the vessel, and may be left as long as necessary in contact with the eye. v. Mittelstädt.

Simi (122) has found in citric acid a means of removing maculæ and even leucomata of the cornea. The drug in concentrated solution is pencilled on daily. After two weeks, in place of the spot there is a depression which is allowed to undergo the usual regenerative process. As soon as the new tissue has reached the level of the corneal surface, the pencilling is repeated, and this is done at intervals until the spot disappears. In this manner the author was able to clear up, within nine months, an opacity for which in the beginning he had intended to perform an iridectomy. Dantone.

Colburn (123) has seen two cases of keratitis bullosa, one of which caused such destruction in spite of all treatment, as to lead to enucleation. The other healed after thorough cleansing of the vesicle and the application of 4 per cent. solution of arg. nitr.

He also reports three cases of pemphigus corneæ which subsided under evacuation of the vesicles and the pressure bandage.

BURNETT.

CAPEI (124) describes a case of bilateral lymph infiltration of the cornea, such as was first described by Rampoldi. The patient was a weak and poorly nourished peasant who worked with his head bent down. The finely granular and star-shaped opacity was so thick that the patient could only perceive movement of the hand. The remaining parts of the eye appeared normal. Under a strengthening general treatment and the local use of eserine, followed later by atropine and daily massage of the cornea, the disease improved and finally got well. A rapid increase in the opacity was noticed repeatedly while he was under treatment. The opacity was always denser in the morning than in the evening. When the patient bent his head down for fifteen minutes, the infiltration increased markedly, particularly in the centre of the cornea. DANTONE.

ADAMÜCK (125) regards the corneal suture as useless in corneal wounds, operative or traumatic. It is indicated, however, in traumatic defects of the cornea. When the apex of a kerato-conus is removed, the round gaping defect heals much more quickly and completely after suturing. HIRSCHMANN.

SIMON (126) gives a description of the microscopic appearance of a corneal tumor. It was a fibroma with foci of myxomatous degeneration.

GULLSTRAND (127) described a case of kerato-conus in which a marked pulsating movement of the corneal images could be recognized with the ophthalmometer. Near the apex of the cone there was a systolic enlargement of the keratoscopic circles, nearer the base there was a systolic diminution of the circles, thus showing a tendency in systole to make the deformity uniform.

SCHIÖTZ.

128. NORSA. The medicamentous electric eye bath in the treatment of scleritis and episcleritis. *Arch. f. Augenheilk.*, xxiv., p. 186.

NORSA (128) found that the use of the constant current by means of a medicamentous fluid (lith. salicyl.) soon improved and eventually cured the affection.

129. PRAGER, C. A case of cysticercus cellulosæ in the anterior chamber. *Wiener klin. Wochensch.*, No. 14, 1892.

Sections XII.–XXI. Reviewed by Dr. P. SILEX.

Translated by Dr. CASEY A. WOOD.

XII.—IRIS.

130. BETTMAN, B. Traumatic Iridodialysis. *The North Am. Practitioner*, Dec., 1891.

131. HESS, C. A contribution to our knowledge of iridodialysis not of traumatic origin. *Zehender's klin. Monatsbl. f. Augenheilk.*, vol. xxx., p. 103.

132. HESS, C. A contribution to the study of iris colobomata in unusual situations. *Zehender's klin. Monatsbl. f. Augenheilk.*, vol. xxx., p. 106.

133. FERGUSON, H. L. Operation on microphthalmic eyes. *Oph. Review*, vol. xi., p. 43.

134. BADAL and FELIX LAGRANGE. Primary carcinoma of the ciliary processes and body. *Arch. d'Opht.*, vol. xii., No. 3, p. 143, 1892.

135. MITCHELL, S. Spasmodic mydriasis a sexual neurosis. *Am. Jour. of Ophth.*, Jan., 1892.

136. KLEBS. Remarks concerning von Donitz's communication on the cure of ocular tuberculosis. *Deutsch. med. Wochenschrift*, No. 50, p. 1358.

HESS (131) observed in a fourteen-year-old child a symmetrically placed iridodialysis without apparent changes in the sclera or cornea.

HESS (132) found a bilateral coloboma of the iris directed inwards and upwards; also a downward choroidal coloboma on the right side, accompanied by other alterations in the eye. "The embryonic connective tissue from which the vitreous and fœtal lens sheath are formed was abundantly and abnormally developed. The incomplete or too late development of these presented on the one hand a complete closure of the optic cleft; on the other it disturbed the growth of the iris by delaying the formation, inward and upward, of the vessel-bearing lens sheath."

FERGUSON'S (133) first case had an iridectomy performed in the left eye for glaucoma. The nerve was atrophied and V= hand-reflex. The right eye had $V = \frac{6}{60}$ with + 18 D. The refraction was 27 D. Both eyes were small and the cornea measured 10 *mm* horizontally, and 0.5 *mm* less vertically. In the second case the corneæ measured about 7 *mm* in diameter. There were extensive posterior synechiæ and opaque lenses. After several iridectomies and needlings V = fingers at 3 *m*. WERNER.

BADAL and LAGRANGE (134) noticed, in a boy eight years of age, a neoplasm of the ciliary body which appeared to have developed shortly after birth. At the age of five the eye had become blind, and when enucleation was later on performed, there was found an intercalary, ciliary staphyloma of the size of a bean; pupil widely dilated; anterior chamber deep; cornea intact; fundus invisible. The tumor was the size of a pea, with a projection from it one third as large; it touched the ciliary region and stretched to the periphery of the shrivelled lens. It presented all the appearances of a glandular carcinoma, and consisted of numerous naked tubules provided with a number of single-nucleated cylindrical cells. The former were partly filled with proliferating cells that had infiltrated the neighboring tissues. The normal elements of the ciliary body had been destroyed and very few vessels and but little pigment could be found. The discovery of a glandular cancer in the *pars ciliaris retinæ* seems to support Nicati's theory of a *glande de l'humeur aqueuse.*

v. MITTELSTÄDT.

MITCHELL (135) has had under observation five cases of spasmodic intermittent mydriasis, two men and three women, in which he believed the condition was brought about by excessive venereal excitement. BURNETT.

XIII.—CHOROID.

137. RINDFLEISCH, G. Experimental examination of the decreased tension attending purulent choroiditis. *Graefe's Archiv. für Oph.*, vol. xxxviii., 2, p. 221.

138. PHILLIPSEN, H. Et Pas Notitser of oftalmologisk diagnostisk. *Inhold. Hosp. Tidende*, S. 783 et 868, Kjöbenhaven, 1891.

139. RUMSCHEWITSCH, K. On some doubtful points connected with pseudo-glioma of the retina. *Zehender's klin. Monatsbl. f. Augenh.*, vol. xxx., p. 230.

RINDFLEISCH (137) found, immediately after the introduction of metallic mercury into the vitreous, increased tension accompanied by marked cloudiness of the retina; then reduction of the tension below normal during the commencing vitreous cloudiness, and its successive diminution as the latter progressed to the stage of suppuration. At the same time the intraocular pressure was found to be plus in the non-injected eye, and it so remained while the affected eye went on to *phthisis bulbi.* The anatomical examination threw no light on the production of the tension.

Phillipsen (138) asserts that partial paralysis of the iris (on the side where the tumor is situated) with good visual acuity is pathognomonic of commencing choroidal sarcoma. Schiötz.

[This symptom is not frequent in the early stage.—H. K.]

Rumschewitsch's case (139) was clinically one of retinal glioma, but after removal of the eye he found an inflammation of the choroid, complicated by detachment of the retina.

XIV.—GLAUCOMA.

140. Kabinowitsch, G. Another instance of the efficacy of iridectomy in a case of glaucoma attended by complete loss of light perception. *Wjestn. Ophthalm.*, 1892, May to June.

141. de Schweinitz, G. E. Coloboma of the iris, polycoria, and primary glaucoma. *Trans. Amer. Ophth. Soc.*, 1891.

142. Schnabel. Glaucomatous affections of the optic nerve. *Archiv f. Augenh.*, vol. xxiv., part 4.

143. Garnier, R. Remarks upon the endarteritic changes in the ocular vessels. *Centrabl. für prakt. Augenheilk.*, vol. xvi., p. 9.

144. Garnier, R. Some observations concerning glaucoma, and the vascular changes associated with and dependent upon it. *Archiv f. Augenh.*, vol. xxv., p. 24.

145. Ulrich, R. The experimental production of glaucoma in rabbits. *Arch. f. Augenh.*, vol. xxv., 1st and 2d part, p. 2.

146. Pomeroy, O. D. A report of cases of glaucoma of different varieties, illustrating some of the usual means practised for their relief. *N. Y. Med. Jour.*, March 19, 1892.

Kabinowitsch (140) saw a case of bilateral glaucoma where perception of light had been completely lost for eight days. Double iridectomy. After five weeks, V R = $\frac{18}{30}$; V L = $\frac{18}{200}$; restriction of the visual field above, in, and below.

In de Schweinitz's case (141), in addition to the unusual feature of an attack of glaucoma in an eye affected with coloboma of the iris, for which an iridectomy was successfully done—as regards these symptoms—the deformity itself is peculiar in that, besides the coloboma itself, there are three other distinct openings in the iris tissue upward and outward. There are also two other places where the iris is very much thinned. BURNETT.

SCHNABEL (142) holds the opinion that the excavation in glaucoma is produced by a retrobulbar neuritis and atrophy of the intraocular portion of the opticus. He believes that not only the fibre-nerves themselves, but all the constituents of the opticus, undergo atrophy. In proof of this, he cites a case where (with one half vision and an almost complete field) there was an advanced atrophy of the nerve-fibres in the non-medullated portion of the opticus. The nervous framework was also affected, and in the medullary segment a chronic interstitial neuritis in various stages was found to extend from behind the lamina cribrosa to the chiasma. That this was an undoubted case of glaucoma is by no means proven. Schnabel has not made allowance for the fact that the ophthalmoscopic picture of optic-nerve atrophy with a pre-existing physiological excavation cannot be distinguished from that of glaucomatous cupping. SCHWEIGGER.

GARNIER (143) speaks of the beaded and diffuse compensatory endarteritis described by Thomas as occurring in many ocular diseases—especially glaucoma. This consists, at the outset, of degenerated hyaline or connective-tissue-like masses between the elastic membrane, and shows itself in those cases where in consequence of the decreased elasticity of the middle muscular coat with secondary local enlargements of the vascular lumen a slowing of blood current results. Since it is especially in cases of glaucoma that these conditions are present, and where, too, the capillaries are much more permeable than normal, slight external causes may bring about increased transudation followed by increase of ocular tension. HIRSCHMANN.

ULRICH (145) produced, by the gradual removal of the cornea of rabbits at several sittings, total anterior synechia. The iris became thickened, fibrous, and atrophic. The ciliary processes were hyperæmic, and showed isolated pigmentary deposits. The congestion followed from the hypersecretion ; indeed, a glaucomatous outbreak showed itself as soon as the cicatricial tissue became firmly attached and made the normal filtration of the fluids no longer possible. As a rule, this happened when the altered iris became the subject of fibrous degeneration at its circumference.

The incarceration of the iris tissue acted directly and the fibrous degeneration and atrophy were the indirect agents in producing a disturbance of the blood supply of the iris. The latter, in its turn, brought about a secondary, collateral congestion of the ciliary processes, thus furnishing evidence, so far as such instances of glaucoma are concerned, in support of the hypersecretion theory.

POMEROY (146) gives full notes of twenty cases (32 eyes) of glaucoma of all forms. Iridectomy was the sheet anchor in treatment, but eserine has proven of great value, generally in solution of 1 gr. to ℥ j, sometimes 2 grs. Paracentesis corneæ has proven useful in temporarily relieving pain. Sclerotomy has also succeeded in relieving pain when iridectomy has failed.

BURNETT.

XV.—SYMPATHETIC OPHTHALMIA.

147. BULLER, F. Conservative surgery of the eye. *Ophth. Rec.*, Jan.-Feb., 1892.

148. JOHNSON, G. LINDSAY. Note on two cases of obscure sympathetic phenomena. Translated from the original manuscript by H. Parent. *Arch. d'Ophtalmologie*, vol. xii. No. 1, 1892, p. 51.

149. SCHMIDT-RIMPLER. Contribution to the etiology and prophylaxis of sympathetic ophthalmia. *Graefe's Arch. f. Ophth.*, vol. xxxviii., 1, p. 199.

While believing that the sympathetic ophthalmia which occurs after the offending eye has been removed is much less virulent than that which occurs when the enucleation has been too long delayed, BULLER (147) nevertheless thinks that the eye of a child should never be enucleated on account of an injury unless sympathetic ophthalmia has actually occurred. He thinks resection of the optic nerve prevents sympathetic ophthalmia oftentimes, and in suitable cases should always be tried before enucleation is finally resorted to. He also practises evisceration, particularly where the injury is confined to the anterior part of the eye.

BURNETT.

G. LINDSAY JOHNSON (148) examined a waiter, æt. 42½ years, who, for 2½ years after an enucleation, wore a glass ball 2 *cm* in diameter within his conjunctival sac. The other eye, until that time healthy, showed these symptoms: transitory ciliary injection, weakness of accommodation, severe pain on pressure over the glass globe, not only in the corresponding orbit, but *at the same time behind the sound eye.* V of the latter normal; J. i. read with hesitation; F of V considerably and to a variable extent constricted; fundus normal. After removal of the artificial vitreous all these symptoms disappeared.

The second case was that of a lady, aged 39, who has been frequently treated for repeated attacks of iritis associated with opacities of the cornea. *The corneæ were so cloudy* ("les deux cornées étaient infiltrées de taches si étendues, qu'elles n'étaient transparentes qu'en deux points") that V, left, = fingers at 1 *m*, and right at 2 *m.* Four days after an iridectomy *on the right eye*, the cornea of the *left* was almost clear, and a proposed iridectomy seemed needless, V = $\frac{6}{9}$ and, J. i. Author had carefully examined these rare cases with other *confrères*, and is undecided whether the disease should be regarded as a *sympathetic* keratitis or not.

v. MITTELSTÄDT.

SCHMIDT-RIMPLER (149) mentions the following peculiar cases: 1. Optico-ciliary neurectomy; sympathetic ophthalmia after 1½ years. Demonstration of normal nerve fibres in the ciliary body of the enucleated stump. 2. Sympathetic ophthalmia without premonitory tenderness on pressure. The first symptom was iritis serosa; then increase of the inflammation due to trauma of the previously injured eye. Recovery. He discards the migration theory, not only because of negative results from experiments, but also on account of the evidence furnished by clinical, morbid-anatomical, and bacteriological investigations. The ciliary-nerve theory appears to him more plausible. He sees in the irritation of the ciliary nerves of the wounded eye (causing a reflected disturbance of the blood circulation and nutrition of the other eye) the single factor in the predisposition to sympathetic inflammation of the opposite organ. In this way the ground is prepared for those influences, be they bacterial or chemical, which light up inflammation. In spite of this opinion he does not reject resection of the optic nerve as a prophylactic measure. When, however, the disease has proclaimed itself, the eye should always be excised.

XVI.—VITREOUS.

150. WAGENMANN. Further communications regarding vitreous suppuration from the scars of iris incarcerations. *v. Graefe's Archiv für Ophthalm.*, Bd. xxxviii., p. 171. (Cases of infection from without through the medium of the cicatrix.)

XVII.—LENS.

151. MAGNUS, H. Ophthalmological charts for academical teaching and private study. II., The development of senile cataract. Breslau, 1892.

152. EWETZKY. Cataract and zerosis of the cornea in glass workers. *Deutsche med. Zeitung*, 8th Oct., 1891.

153. FUCHS, E. On lenticular precipitates. *Beiträge zur Augenhlk.*, pt. 3, 1891.

154. MITVALSKY. A recent case of lenticonus posterior with partial persistence of the hyaloid artery. *Centralb. f. pkt. Augenheilk.*, xvi., p. 65.

155. TOPOLANSKI, A. Irregularities of the lenticular border. *Zehender's klin. Monatsbl. f. Augenhlk.*, vol. xxx., p. 89.

156. RYERSON, G. S. Miscellaneous facts regarding the extraction of cataract. *Ophthalmic Record*, Jan.-Feb., 1892.

157. PFLÜGER. Observations on the present state of cataract extraction. *Zehender's klin. Monatsbl. für Augenheilk.*, vol. xxx., p. 155.

158. SCHULECK, W. A new method of cataract extraction. *Pester med.-chir. Presse*, No. 23, 1892.

159. WAGNER. Report of 1,000 extractions with small peripheral flap (von Graefe's method). *Wjestnik Ophthalm.*, 1892, No. 1.

160. DOLSCHENOW. Review of 400 cataract extractions. *Wjestnik Ophthalm.*, 1892, No. 1.

161. WEBSTER, DAVID. Report of 136 cases of cataract extraction with remarks. *Trans. Am. Oph. Society*, 1891.

162. LIPPINCOTT, J. A. Routine syringing out of cortical substance in cataract extraction as illustrated in 100 cases. *Trans. Am. Oph. Society*, 1891.

163. ARNOLD, TH. Report of 400 cataract extractions performed by Prof. O. Haab on patients in the Zurich University clinic and in his private hospital. *Arch. für Augenheilk.*, Bd. xxv., Pts. 1 and 2, p. 41.

164. HIRSCHBERG, J. On extraction of nuclear cataract. *Berlin. klin. Wochenschrift*, 1892, p. 635.; *Sem. Centralblatt.*

165. HJORT. Cataract extraction without iridectomy. *Norsk Mag. f. Laegerid, Christiania*, 1891, p. 643.

166. Kramsztyk. Fate of the iris after cataract extraction. Congress of Polish physicians and naturalists, 1891. *Zehender's klin. Monatsbl. f. Augenheilk.*, vol. xxx., p. 294.

167. Simi. Suture of the cornea after extraction of cataract. *Boll. d'Ocul.*, vol. xiv., p. 1.

168. Buller, F. Glaucoma after cataract extraction. *Trans. Am. Oph. Soc.*, 1891.

169. Keyser, P. D. Remarks on extraction of cataract. *Annals of Oph. and Otol.*, Jan., 1892.

170. Wood, Casey A. A contribution to the study of concussion cataract. *Ann. of Oph. and Otol.*, Jan., 1892.

171. Knapp, H. The occurrence, prevention, and management of prolapse of the iris in simple extraction of cataract. *Trans. Amer. Oph. Soc.*, 1891.

172. Theobald, S. Supplementary note to the case of useful vision maintained by the aid of a totally dislocated lens, heretofore reported to the society.

173. Roosa, St. John. The best operation for the extraction of cataract. *Ann. of Oph. and Otol.*, Jan., 1892.

174. Randolph, R. L. A series of fifty consecutive operations for cataract. *Johns Hopkins Hosp. Bull.*, No. 20, March, 1892.

Magnus (151), in a series of eleven plates, illustrates the development of cataract in a manner that might be expected from his numerous recent and well known studies of the subject. In a few minutes one can be thoroughly informed upon everything pertaining to this matter.

Ewetzky (152) lays the blame upon the very great heat encountered during the work.

Fuchs (153) means by "lens precipitates" dotted markings of a grayish-brown color, on the inner wall of the cornea, that are associated with swelling of the lens. The aqueous humor contains much fibrin and pigment cells derived from the posterior surface of the iris. Absorption takes place readily.

Topolanski (155) states that the lenticular border is not always smooth but is frequently wavy and, particularly above, presents cone-shaped projections.

As a rule Ryerson (156) closes his extractions with an iridectomy, but lately has been trying the simple method. He uses eserine after the operation, but in weak solutions. In some cases he washes out the anterior chamber with Panas' solution. He uses a knitted Liebreich bandage. Has abolished dark rooms and does not confine his cases to the bed. He has operated successfully on eight patients between eighty and ninety years of age. His extractions number 250. BURNETT.

PFLÜGER (157) replies at length to questions propounded by Landolt. He is such a firm believer in both asepsis and antisepsis that he operates, when at all possible, without iridectomy. He does not consider that every cataract after the sixtieth year is fit for extraction. Washing out the anterior chamber is, to his mind, a valuable adjunct to the technique, and for the purpose he uses a boric solution or trichloride of iodine 1:4000. Discission wounds more readily tend to infection than others. Shreds of vitreous hanging out of the wound of incision are best treated by touching them with the galvano-cautery.

WAGNER'S (159) 1,000 cases of cataract operation are divided into three classes: (1) 474 extractions without antiseptics, with 8.86 per cent. of losses. (2) 223 extractions under strict antiseptic precautions, but performed, like the first group, in general hospitals, with 5.82 per cent. of loss. (3) 303 extractions, antiseptic, but made in the well arranged eye hospital of Odessa, with but 2.43 per cent. of failures. Before practising Graefe's method, which Wagner still employs in all his cases, complicated and uncomplicated (his statistics include all cases without exception), he made the classical flap operation and had 16 per cent. of failures. The first group furnished 16 discissions and 3 extractions of secondary cataract, 19 iridectomies and 18 iridotomies; the second, 6 discissions and two extractions of secondary cataract, 5 iridectomies and 6 iridotomies; the third, 2 discissions, 2 secondary extractions, and 2 iridectomies. Wagner is opposed to extraction without iridectomy and to extractions with the capsule entire. Wagner regards the use of the spring speculum and the fixation forceps as indispensable up to the moment of the removal of the lens. Many years of experience have convinced Wagner of the superiority of the Graefe method; he would still practise the preliminary iridectomy when, all things considered, it is permissible.

In making extraction by the simple method WEBSTER (161) tries to include a little less than half of the circumference of the cornea and endeavors to get a small conjunctival flap. He uses eserine in weak solution after the operation.

The eye is not examined for forty hours. In 116 simple extractions there was 91 per cent. of good results, 5 per cent. of medium, and 3 per cent. of failures. In 20 cases by "Gräfe's method" there was 75 per cent. good, 15 per cent. medium, and 10 per cent. of failures. In the simple extractions prolapse occurred in 4 per cent. of the cases. He believes in early excision in cases of prolapse. BURNETT.

LIPPINCOTT (162) makes a preliminary iridectomy generally downward.

The incision, in extraction, lies wholly in the cornea and embraces $\frac{2}{5}$ to $\frac{1}{2}$ of the corneal circumference. The lens is delivered by pressure of the thumb against the upper-lid edge at the upper margin of the cornea, and the anterior chamber washed out by means of a syringe of his own devising, with a solution of boric acid 2 to 4 grs. to ℥j. A quantity varying from 2 drachms to 2 or 3 ounces is allowed to pass in and out of the anterior chamber.

All the cases are tabulated. Two cases had occluded pupils and one case was lost after the preliminary iridectomy, from suppurative panophthalmitis, though the operation was done under strict antisepsis. The author's anterior chamber syringe is figured. BURNETT.

After a careful statistical examination in reference especially to the operative procedure, the eventual visual acuity, complications, secondary operations, etc., ARNOLD (163) concludes that the combined operation is to be preferred to the simple method. Cases of lamellar cataract are never treated by optical iridectomy.

HIRSCHBERG (164) reports over 200 cases. 75 obtained V of more than $\frac{1}{3}$; 10 per cent. had diabetes.

Prof. HJORT (165) prefers extraction without iridectomy and believes that by a modification of his former method of placing the corneal incision the danger of iris prolapse is lessened. Previously the highest point in the corneal flap never approached nearer than $\frac{3}{4}$—1 *mm* to the limbus; now he makes a cut parallel with the plane of the iris so that it lies entirely within the transparent margin of the cornea and often forms a small conjunctival flap. SCHIÖTZ.

SIMI (167) objects to Suarez' method of suturing the cornea after cataract extraction. The writer would feel inclined to resort to the suture only in those exceptional cases where, owing to the restlessness of the patient, there is danger of rupturing the recently healed wound. In such instances he prefers the scleral stitch of Barramer. DANTONE.

BULLER (168) has seen glaucoma supervene in three eyes after cataract extraction. In two it came on some years after the operation, and was of the simple non-inflammatory type. In the other it was of the sub-acute variety and eserine had a beneficial effect. He thinks that excessive use of the eyes may have had some effect as a cause. BURNETT.

KEYSER (169) has had as good success in extracting unripe cataracts as ripe ones, and pays special attention to the manner of dividing the anterior capsule. He usually makes a T-shaped incision, but thinks removal of a piece by means of Wecker's forceps good. For ordinary ripe cataracts he thinks simple extraction the better method. BURNETT.

WOOD (170) is inclined to consider some cases of cataract which come on very soon after concussion, of which he relates the history of two, as due to a physical displacement of the molecules of the lens-substance. BURNETT.

KNAPP (171) regards iris prolapses as the weak point in simple extraction, and one against which it is most difficult to guard. Its frequency of occurrence varies in his own statistics from 6 per cent. to 12 per cent. For its prevention he advises: (1) To make an iridectomy when, in the particular cases, all points considered, the combined method offers better chances for restoration of sight than simple extraction; (2) cocainize thoroughly; (3) make the corneal incision in the classical way of Beer; (4) cleanse the anterior chamber thoroughly; (5) open the capsule by one long horizontal incision in the upper part under the iris; (6) avoid prolapse of vitreous and everything that ruptures the transverse septum of the globe; (7) carefully replace the iris; (8) myotics may be used; (9) keep the patient as quiet as possible for the first day or two; (10) watch the patient or tie his hands during the night for the first five or six days. After prolapse has occurred let it alone for several weeks. If it should not diminish by that time abscise. Early abscissions, except in the first twenty-four hours he does not think wise. BURNETT.

THEOBALD (172) reports in regard to a case of dislocated lenses—that ten years afterward in the left eye the lens had become cataractous and finally the capsule ruptured, the contents being diffused into the vitreous with symptoms of glaucoma. Under treatment these symptoms disappeared and the vitreous cleared up, and vision was restored with glasses to the former state of $\frac{20}{40}$. The lens floating in the vitreous of the other eye is intact and gives no inconvenience. BURNETT.

ROOSA (173) prefers the simple extraction for straightforward cases, reserving the linear operation and preliminary iridectomy for exceptional cases. He uses eserine after the extraction in the simple operation and still adheres to the flannel bandage.

BURNETT.

The principal interest in this series of operations (174) attaches itself to the fact that the operations were done for the most part in the cabins of negroes in the country or under other unfavorable conditions. An iridectomy was made, as a rule. Two eyes were lost—one from internal hemorrhage and one from corneal suppuration. BURNETT.

XVIII.—RETINA AND FUNCTIONAL DISTURBANCES.

175. ROSENTHAL. Case of snow-blindness. *Hygeia*, p. 299, Stockholm, 1891.

176. AYRES, S. C. Retinitis pigmentosa in the colored race. *Amer. Jour. Ophth.*, March, 1892.

177. BULL, C. S. Operative treatment of retinal detachment by Schöler's method, with a report of five cases. *Trans. Amer. Ophth. Soc.*, 1891.

178. SCHOENFELD, W. Contributions to the treatment of retinal detachment. *Inaug. Dissert.*, Berlin, 1892.

179. ALEXJEW. A case of hemorrhagic retinitis in progressive pernicious anæmia.

180. BJERRUM, J. Et tilfeede af embolia art. centr. retinæ med. et ejen dommaligt kredslöbsfænomen. *Nord. Ophth. Tidsk.*, vol. iii., p. 270, Kjöbenhavn, 1891.

181. PERLES, M. Clinical studies of vascular disease of the eye. On partial embolism of the retina. *Centralbl. f. prakt. Augenhlkde.*, vol. xvi., p. 161.

182. LÖWENFELD, L. The objective signs of neurasthenia. *Münch. med. Wochenschrift*, No. 50, p. 856.

183. WILBRAND and SÄNGER, A. Further observations on visual disturbances in functional diseases. *Jahrb. der Hamburger Staats-Krankenanstalten*, 1890, part 1.

184. KÖNIG. On fatigue of the retina and its connection

with concentric restriction of the visual field in diseases of the central nervous system. *Neurol. Centralbl.*, 1892, p. 449.

185. GRAEFE, A. Note on the use of the prism in detecting simulation of unilateral amaurosis. *Żehender's klin. Monatsbl. f. Augenhlkde*, vol. xxx., p. 260.

186. HEYL, A. J. The calibre of the retinal vessels after traumatic injury to the convexity of the brain. *Trans. Amer. Ophth. Ṣoc.*, 1891.

187. SUTPHEN, T. Y. Amaurosis in women. Three clinical cases. *Trans. Amer. Ophth. Soc.*, 1891.

AYRES (176) relates the history of a case of retinitis pigmentosa in a negro man of forty-five. [The reviewer has seen retinitis pigmentosa in the negro race a number of times.]

BURNETT.

BULL (177) gives the history in detail of five cases of detached retina which he treated by Schoeler's method of injection of tincture of iodine after other methods had failed. In none were any permanent good results obtained. BURNETT.

SCHOENFELD (178) shows from a study of the literature of the subject, and from a history of twenty-three patients treated in the University Clinic in Berlin by Schœler's method of injecting iodine that no advance has thus been made in the treatment of retinal detachment.

Although retinal hemorrhage is common enough, its occurrence with progressive anæmia is so rare that ALEXJEW (179) can find only three cases in literature.

In a case of embolism of the arteria centralis BJERRUM (180) noticed (in an artery) during the first two or three days a rapid and continuous current in a *centripetal* direction. The blood was very dark and contained small clots; later on it presented the ordinary bright-red color of the remaining arteries.

SCHIÖTZ.

PERLES (181) reports six cases. The hope of regaining central vision is well founded when there is an uninterrupted current in the affected arteries or when they pulsate on bulbar pressure. Treatment consists of faithful and energetic massage under cocaine.

WILBRAND (183) desires to replace with the term nervous asthenopia the name neurasthenic asthenopia = anæsthesia retinæ = peripheral amblyopia of the visual field, formerly employed by him. He includes in it all the various symptoms that accompany functional disturbances of the nervous system. He discusses the nervous asthenopia of school children, that occurring during the developmental period, that seen in neurasthenic adults, and especially that noticed in hysterical persons. Lastly he refers to the neuroses occurring in traumatic cases.

Of 215 patients examined by König (184) in the Dalldorf Lunatic Asylum, 81 had defects of the visual field. They all showed the Förster-Wilbrand "fatigue" symptoms (the examination being first made in the horizontal meridian) and a symmetrical concentric contraction. The observations of others were confirmed that the fatigue is most marked at the commencement; that the temporal side is more readily tired out than the nasal, and that in some instances the temporal side alone is thus affected. Of interest is the description of one case of the so-called "oscillating field" (partial disappearance of the perimetric object) which had lasted one and a quarter years. Simulation of a regular limitation of the visual field, with or without the "fatigue" symptom, is said to be impossible.

Graefe (185) recommends that the diseased eye be covered while a prism of 18°, base down, is placed below the sound eye and slowly raised in front of it. At a certain point the patient has diplopia and learns that there is nothing suspicious about double images. The other eye is now opened and the experiment repeated in such a way that if he sees two images one can be sure that the alleged blind eye is really capable of vision.

The gist of Heyl's (186) paper and the histories of the cases which he cites (twelve in number) tend to show that there is an immediate connection between the calibre changes in the retinal vessels and delirium and sopor alternans. The retinal changes, however, he thinks probably indicate a corresponding change in the large intracranial trunks. The relations of such change, however, are unknown. Burnett.

Sutphen's (187) cases are: (1.) A healthy girl of eighteen was driven out-of-doors bare-foot and in her night dress, and walked in the snow a quarter of a mile during her menstruation. Eight weeks after, vision in right eye began to fail. Ophthalmoscope failed to reveal any adequate cause for the blindness except that the vessels seemed smaller than normal—fingers at two feet. Some weeks later the left eye went suddenly, entirely blind. (2.) Six weeks after confinement a woman was suddenly seized with severe headache, and vision in the right eye was lost. Two weeks later the other eye became suddenly blind. Vision became at times somewhat better but finally it remained p. l. in L. and fingers at ten feet in R. Discs pale and signs of atrophy. (3.) A case of blindness in one eye lasting three months, followed by improvement, without any cause, local or general.

BURNETT.

XIX.—OPTIC NERVE.

188. BEER. On a case of optic-nerve disease in *uterus infantilis*. *Wien. klin. Wochenschrift*, 1892, Nos. 30, 31. (Retrobulbar neuritis; finally full visual acuity with pallor of the papillæ.)

189. OTTO. On changes in the optic nerve, particularly in cases of arterial sclerosis. *Centralb. f. Neurologie*, S. 447, 1892.

190. LEBER. Peripheral optic-nerve affections in hysterical subjects. *Deutsche med. Wochenschr.*, 1892, p. 741.

191. DEUTSCHMANN. On acute retrobulbar neuritis of rheumatic origin. *Beiträge zur. Augenheilk.*, pt. vi., p. 899.

192. GROENOUW. On toxic amblyopia. *v. Graefe's Archiv f. Ophthal.*, vol. xxxviii., 1., p. 1.

193. RYDEL. On the question of amblyopia as a result of alcohol and tobacco poisoning. Congress of Polish Physicians and Naturalists, 1891. *Zehender's klin. Monatsbl. f. Augenheilk.*, vol., xxx., p. 294.

194. DE SCHWEINITZ, G. E. Additional experiments to determine the lesion in quinine blindness. *Trans. Amer. Oph. Soc.*, 1891.

195. CALLAN, P. A. Two cases of orbital traumatism resulting in immediate monocular blindness through fracture into foramen opticum. *Trans. Amer. Oph. Soc.*, 1891.

196. TAYLOR, L. N. A case of brain tumor with high grade of choked disc; autopsy. *Trans. Amer. Oph. Soc.*, 1891.

197. HUBBELL, A. A. Optic neuritis as a form of peripheral neuritis. *N. Y. Med. Jour.*, Jan. 22, 1892.

198. WOOD, CASEY A. The retrobulbar neuritis of young adults. *Ophthalmic Record*, June, 1892.

OTTO (189), in discussing the topography of the optic nerve behind the foramen opticum, describes some congenital malformations discovered by him. He also asserts that the mechanical influence of dilated and calcified vessels often produces organic changes. Certain forms of atrophy in old people are probably associated with these alterations.

Leber (190) has observed a number of cases of hysterical amblyopia and amaurosis which were the outcome of a retrobulbar neuritis. In spite of rapid restoration of vision sometimes pallor of the disc showed itself later on. Of five cases four were women. This orbital neuritis, which may quickly get well without treatment, probably leaves behind it, according to Leber, a disturbance of optic conduction, which, in its turn, disappears or goes on to atrophy.

Deutschmann (191) describes seven cases in which no other cause than cold could be discovered. The disease probably began as a simple periostitis about the foramen opticum.

Groenouw (192) presents the well-known clinical picture—defective vision, intact peripheral field with oval scotoma for red between fixation point and blind spot, unchanged light sense, etc.—and from an examination of 178 cases concludes that the disease is most common between the fortieth and fiftieth year, and its principal cause is tobacco. Only two cases could be charged to alcohol alone. In the obstinate cases recovery set in only after six months. The characteristic and constant symptom is a central defect for red. The combined extent of the scotoma in advanced cases measured 22° in the horizontal direction and 16° vertically. Worthy of remark are the cases of slowly progressive optic atrophy accompanied by peripheral limitation of the field. In the matter of differential diagnosis there is to be considered chiefly axial neuritis, which, however, besides perimetric defects in the form of re-entrant angles, shows central scotomata for red *and* white.

De Schweinitz (194) presented some photomicrographs made by Dr. Gray of the Army Med. Museum showing the effects upon the nerve tissue in artificial quinia poisoning made in experiments by De Schweinitz. The results seem to show that the effects of toxic doses of quinia are upon the whole visual path, including the optic nerves, chiasma, and tracts as far as they can be traced. The other nerves of the eye do not seem to be affected. The process probably begins by a constringing of the vessels through the vasomotor nervous system and finally inflammation is set up —probably an endovasculitis—in which thrombosis may occur resulting in atrophy. The experiments were made mostly on dogs. Burnett.

In Callan's (195) first case, the point of a fencing foil entered the orbit between the nose and eyeball. There were symptoms of orbital cellulitis and the fundus was hazy and the nerve finally became white, though there is still some vision on the nasal side. In the second case the blow was over the left eye and blindness was said to have been immediate. There was, fifteen hours after the injury, no change observable in the fundus, but in a week the nerve began to grow pale, and in three weeks the atrophy was pronounced. Burnett.

Taylor's (196) case was a boy of seventeen. He had at first examination $V = \frac{20}{30}$ though there was a high degree of papillitis. His principal complaint was dizziness and persistent headache. Subsequently atrophy and blindness ensued. There was some exophthalmos particularly in right eye; some slight paresis, but no permanent paralysis. He died suddenly, and a tumor was found between the cerebrum and cerebellum, which arose from the corp. quad. and roof of the fourth ventricle. The tumor was a glioma. Burnett.

Hubbell (197) thinks that from analogy and also from direct evidence we are warranted in regarding optic neuritis as a form of peripheral neuritis and dependent upon general systemic conditions. Burnett.

Casey Wood (198) reports two cases of retrobulbar neuritis, one a woman, the other a man, in both of whom there was remaining a perfect central scotoma for white, and a scotoma for colors extending 5° to 10° outside of this.

The fundus and nerve-head remained normal. He considers that usually such cases go on to recovery. Burnett.

XX.—INJURIES, FOREIGN BODIES, AND PARASITES.

199. Gotti. Two important cases of ocular traumatism. *Bull. d. Scienze mediche*, series vii., vol. iii.; and *Boll. d'Ocul.*, vol. xiv., p. 6.

200. Straub. Een tweetal verwondingen der oogholte en haar mechanisme. *Weekblad van het Nederlandsch Tijdschrift voor Geneeskunde*, vol. ii., p. 565, 1892.

201. Ramm. Enucleation of the eye; meningitis; death. *Norsk. Mag. f. Laegerid*, p. 502, Christiania, 1891.

202. Roosa, St. John. Extraction of foreign bodies from the eyeball. *Trans. Am. Oph. Society*, 1891.

203. Prager. A case of cysticercus cellulosæ in the anterior chamber. *Wien. klin. Wochenschrift*, 1892, p. 209.

204. Seyfert. Contributions to the operative treatment of intraocular cysticercus. *v. Graefe's Archiv f. Ophthalm.*, vol. xxxviii., 2, p. 112.

205. Hirschberg, J. On trichinosis of the human eye. *Berlin. klin. Wochenschr.*, 1892, p. 325.

206. Holt, E. E. Extraction of foreign bodies from the vitreous. *Trans. Amer. Oph. Soc.*, 1891.

207. Schwartzschild, H. Davidson. A case of palimptosis alternating with proptosis following injury. *Med. Record*, May 4, 1892.

In one of Gotti's *two* cases (199) of injury to the eye a large grain of shot entered the anterior chamber. Twenty-four hours afterwards not a single trace of the wound could be found. It was supposed that the blood in the anterior chamber resulted from simple contusion, and after the disappearance of the first signs of irritation the patient was discharged as practically cured. But after a year had passed severe symptoms suddenly manifested themselves. On incising the cornea an abundant aqueous exudation poured out and disclosed the presence of a No. 6 shot. On removing the latter the eye was again restored to health. The *second* case was that of a total detachment of the iris following a collision with the corner of a chair. The only sequelæ were three small scleral staphylomata and marked photophobia in a very bright light. Dantone.

In Ramm's case (201) the eye was destroyed by a penetrating wound from a splinter of wood. The foreign body had been removed and the wound healed with a total anterior synechia. When seen the eye was red, the conjunctiva chemotic, the globe hard, and there was much pain. The eye was excised under strict antiseptic precautions; instruments and absorbent cotton were sterilized by means of Arnold's steam apparatus; the parts were cleansed with sublimate solution, and the orbit was stuffed with iodoform gauze. There was a little pain the first evening, which disappeared with the removal of the tampon. Next day fever and delirium. Wound washed out with $\frac{1}{10}$ % sublimate solution. Death on the second day. Autopsy revealed purulent infiltration at the base and convexity of the brain. No foreign body found in the enucleated eye. SCHIÖTZ.

ROOSA (202) reports three cases. (1) That of a bit of metal entangled in and removed from the tissue of the iris which had been drawn out through a corneal incision. The iris was replaced and the case did well. (2) A bit of thin wire 12 *mm* long was lodged in the lens near its equator and projected into both the anterior and vitreous chambers. The anterior chamber was opened by an incision and the wire seized by its point and pulled out. Recovery good. Patient could distinguish small objects at twenty feet. The third case was a foreign body—bit of steel—in the vitreous chamber, which was removed in the usual manner by the electro-magnet. Vision was nearly normal. BURNETT.

SEYFERT (204) reports six cases operated upon in the Göttingen clinic between 1886 and 1889. In three of these permanent vision was secured, while all six globes were saved. Result similar to those obtained in the clinic at Halle.

HIRSCHBERG (205) treats exhaustively of every possible subject connected with tapeworm and cysticercus—history, developmental stages, channels of infection, duration of life, with statistics relating thereto,—and concludes that the strict inspection of meat (in Germany) has almost driven out the disease. In the course of the year he has treated 41 cases of trichinosis. In 32 instances where the parasite lay beneath the retina and in the vitreous he succeeded in obtaining lasting visual results.

HOLT (206) reports six cases in all of extraction of foreign bodies from the vitreous. In four the extraction was made by means of a Bradford magnet. In all except one the vision was restored to its normal condition. In one case the removal was affected by means of a Mathieu's forceps which was introduced into the vitreous, and search made for the body until it was found. In this instance the vision was not good, but the form of the eyeball was preserved. BURNETT.

In the case reported by SCHWARTZSCHILD (207) a man of twenty-eight received a violent injury to the head when he was a boy of eight. When seen by Schwartzschild there was a sinking of the eye deep in the orbit, which was changed into an exophthalmos when the patient leaned the head forward and downward. Vision was good and fundus normal. No pulsation or bruit. The writer does not think that the proptosis is due to vascular disturbance, owing to the entire absence of the symptoms of such condition ; but holds that it is most likely due to air which enters the orbit from a communication with the frontal sinus caused by the injury.

BURNETT.

XXI.—OCULAR AFFECTIONS IN CONSTITUTIONAL DISEASE.

208. MAGNUS, H. Ophthalmological charts for academical teaching and private study. Breslau, 1892, I. The diagnosis of central disease of the optical apparatus.

209. KORTNEW. On cataract as a result of ergotism. *Wjestn. Ophthalm.*, 1892, No. 2.

210. HANSEN. Ocular diseases following influenza. *Hosp. Tidende*, p. 1229, Kjöbenhavn, 1891.

211. ANTONELLI. Neuritis optica retrobulbaris and papillitis from influenza. *Ann. di Ottalm.*, vol. xxi., 2–3, p. 119.

212. DEUTSCHMANN, R. Morbid changes in the eye in leukæmia. *Beiträge zur Augenheilk.*, 1892, part 4.

213. VOSSIUS, A. A case of ocular disease from lightning. *Beiträge zur Augenh.*, 1892, part 4.

214. v. HIPPEL, E. On debated questions connected with tumors of the pituitary body. *Virch. Archiv*, vol. cxxvi.

215. BOLTZ, R. A case of acromegaly with bitemporal hemianopsia. *Deutsch. med. Wochenschrift*, 1892, p. 634.

216. BULL, C. S. Report of a case of brain tumor, with autopsy. *Trans. Am. Oph. Soc.*, 1891.

217. MADER. Discussions of debated questions. *Wiener med. Blätter*, 1892, Nos. 4 and 6. (1.) Right sided hemianopsia of both eyes, caused by white softening of the right occipital lobe. (2.) Sarcoma of the right frontal lobe; visual disturbance ; choked disc.

218. ZIEM. Exophthalmus and thrombosis of the cerebral sinus. *Wien. klin. Wochenschrift*, 1892, Nos. 26 and 27.

219. OLIVER, C. A. A clinical study of the ocular symptoms found in the so-called Mongolian type of idiocy. *Trans. Am. Oph. Soc.*, 1891.

220. SÄNGER. A study of nervous affections in the early stage of syphilis. *Jahrb. der Hamburger Staats-Krankenanstalten* Jahrg. 1890, part 1.

221. Christ, A. On debated questions in nuclear ophthalmoplegia. *Deutsches Arch. klin. Medicin*, vol. xlvi., parts 5 and 6.

222. Borthen, L. The local diagnostic conditions in unilateral, isolated, reflex iridoplegia. *Zehender's klin. Monatsbl. für Augenheilk.*, vol. xxx., p. 121. [Probably disease of the sphincter nucleus.]

223. Redlich. On the peculiarities of reflex iridoplegia in progressive paralysis. *Neurol. Centralbl.*, 1892, p. 307.

224. Graddy, L. B. Report of a case of blindness concomitant with la grippe — permanent (?) impairment of visual fields. *Oph. Rec.*, June, 1892.

225. De Schweinitz, G. E. A note on asthenopia and intranasal disease. *Med. News*, April 2, 1892.

226. Ranney, A. L. Some prevalent errors relating to "eye-strain" as a cause of nervous derangement. *N. Y. Med. Jour.*, June 11–28, 1892.

227. Batten, R. D. Myopia the result of constitutional disease. *Ophthalmic Review*, vol. xi., 1.

These plates from the hand of Magnus (208) constitute, in form and contents, a splendid gift to both physicians and students. They cannot be too strongly recommended.

During a widespread epidemic of ergotism in the Government of Wjatka, Kortnew (209) observed patients with two different kinds of visual disorders. One class complained of a transitory cloudiness of vision, when V fell to $\frac{20}{100}$ and less. This symptom lasted several minutes, but its occurrence varied greatly from several attacks daily to one in a month. It was present most commonly in connection with the more pronounced convulsive attacks. In patients of the second class, the visual failure was gradual and permanent. In both of them, lenticular opacities appeared and spread from the centre to the periphery. 37 such patients, from six to fifty-four years of age, were discovered in 500 cases of poisoning. In the younger patients the cataract matured in from 2 to 3 months, but in the adults it occupied from 8 to 12 months. Its extraction and the subsequent healing of the wound were not marked by any unusual incident, except a decided tendency to loss of vitreous. During the discission of semifluid cataracts Kortnew observed that absorption was very tedious, and in two cases, after each discission, severe attacks of convulsions, due to the ergot poisoning, set in. Hirschmann.

Antonelli (211) reports two cases of optic-nerve disease following influenza. In the first instance, there was a gray-green discoloration of the papilla in both eyes. $V = \frac{1}{10}$ to $\frac{1}{12}$; visual field showed a slight limitation outwards, and was defective for red and green. Diagnosis: old retrobulbar optic neuritis. The second case was a marked example of bilateral neuro-retinitis. Both eyes were very myopic and vision was fingers counted at 1 *m*, while color-sense was entirely lost. Field of vision normal. In both cases the ocular symptoms showed themselves as the influenza disappeared and convalescence set in. Dantone.

Hippel's case (214) of sarcoma affecting the pituitary body in a woman presented the following symptoms: headache, amblyopia, transitory paralyses of ocular muscles, choked discs, and, later, optic atrophy.

Boltz (215), in view of the fact that the post-mortem examination of four cases of acromegaly demonstrates an enlargement of the pituitary body, conjectures that in his case there was also a tumor of the latter organ.

The peculiarity about Bull's (216) case is that the patient a man of forty-five, had had no pain in the head at all except as he died. As regards the eyes, there was for a year or more before death an inequality in the size of the pupils. Nine months before death, there was a marked ptosis of the right upper lid and paresis of both internal recti. In the left eye the pupil was moderately dilated and immobile. There was crossed diplopia and the right image was lower. Moderate neuro-retinitis in the right eye with some small hemorrhages. Under treatment, all these symptoms disappeared. Later there was some vertigo. He died in a sudden attack and in delirium. The autopsy showed a tumor —glio-sarcoma—involving the corpus callosum and protruding downward from the roof of the lateral ventricle. There was no sclerosis of the nerve tissue in any part of the brain.

Burnett.

Oliver (219) has made extensive studies of the subjects in the Pennsylvania Institute for Feeble-Minded Children, and reports in this paper on the changes found in the Mongolian form of idiocy. He attributes the peculiar shape of the palpebral aperture to the form of the orbits and their relation to each other, and to the peculiar attachments of the ligaments inherent in the form of the skull. There are nearly always appearances of low forms of neuro-retinitis and choroiditis. Other changes, both intra-ocular and extra-ocular, are due evidently to imperfect development.

BURNETT.

SÄNGER (220) reports six cases of syphilis in its early stages where marked anatomical changes had taken place in the nervous system, and cautions us not to imagine that the first manifestations of the disease are confined to the skin and mucous membranes alone. In the patients referred to he found retrobulbar neuritis, bilateral atrophy, and muscular pareses, which were first indicated by a decided concentric limitation of the field.

In CHRIST'S (221) case a gliosarcoma of the pineal gland had given rise to a trochlearis paresis.

BORTHEN'S (222) case is as follows: a sailor, æt. thirty-seven, was infected nineteen years before and suffered from pains in the head and vertigo associated with a unilateral, isolated reflex iridoplegia. Of the three possible explanations of these symptoms, viz., nuclear disease, affection of Meynert's fibres (as well as of those joining the two oculo-motor centres), and spinal irritation, the writer prefers the first.

REDLICH (223) has discovered that, in the case of those paralytics whose one eye shows a reflex iridoplegia while the pupil of the other still reacts to light, the former produces a consensual reaction upon the latter. The converse of this is, however, not true. This is explained by postulating a partial crossing of the pupillary fibres of the opticus outside the chiasma or the posterior commissure.

In GRADDY'S (224) case a woman in the third week of an attack of the grippe developed a sudden blindness, which after many fluctuations from better to worse finally settled down to a left hemianopsia. The optic disc had not changed its appearance in any important particular. The blindness is evidently due to an intracranial affection. BURNETT.

DE SCHWEINITZ (225) reports three cases of asthenopia with ametropia and heterophoria, in whom the correction of these anomalies failed to relieve the patient, and where the treatment of the rhinitis was followed by great benefit. BURNETT.

RANNEY (226) is a neurologist who has given much attention to "eye-strain" as a cause of nervous derangements. He here brings forward the question again and gives, in support of his opinion, the histories of eighteen cases in full. Among the conclusions at which he arrives are the following, which may be of interest.

Atropine mydriasis is the only condition for a scientific determination of refraction. Correction of muscular anomalies is of little or no value until errors of refraction have been carefully corrected. Eye-strain is a frequent cause, and perhaps the most important of all factors that tend to produce functional nervous disease.

He has never seen a case of typical sick-headache which was not associated with eye-strain. The commonest causes of nervous derangements are esophoria, hyperphoria, and hypermetropia. Exophoria and myopia are less frequently causes.

BURNETT.

BATTEN (227) imagines that high pulse tension and other vascular changes are a common cause of myopia ; eighteen illustrative cases are described, the last being headed, " Myopia and chronic bronchitis in a child " ! What a wonderful coincidence !

WERNER.

BOOK REVIEWS.

1. The Relations of the Visual Organ and its Diseases to the other Diseases of the Body and its Organs. (Die Beziehungen des Sehorgans, etc.) By Dr. MAX KNIES, Prof. University of Freiburg; J. F. Bergmann, Wiesbaden, 1893; 484 large octavo pages, with many illustrations in the text, and a good index.

1. This book is one of the most important and interesting treatises that have appeared since the *Handbuch* of Græfe-Sämisch. It treats of the subject in the same way, only more extensively, than Förster did 16 years ago. The advances in this department during the last 16 years have been enormous, especially in neurology with which ophthalmology is so intimately connected. The author gives in detail all the anatomical and physiological facts that have any bearing on his subject, thus furnishing invaluable demonstrations and explanations of the numerous and intricate pathological phenomena which the eye exhibits in other diseases of the body. The occurrence of ocular symptoms, their detection and significance in diseases of the nervous system, occupies 255 pages a little more than half of the whole book. This most important department is analyzed and presented with such clearness and thoroughness that no neurologist, oculist, or general practitioner will resort to it without finding what is known on the subject. Even the surgeon will receive most valuable information as to the origin and significance of ocular symptoms produced by brain lesions for which the skull should, or should not, be opened. The connections of eye diseases with those of other organs of the body and general diseases are discussed with due thoroughness according to their importance. The style of the book is concise and eminently clear. The author calls the work under consideration the second part of his treatise of ophthalmology (J. B. Bergmann, 2d edition), and a supplementary volume to every text-

book of internal medicine or ophthalmology. We can heartily endorse this statement and would add that the book ought to be translated into English. H. K.

2. **Les Maladies des Yeux dans leurs Rapports avec la Pathologie Générale.** By Dr. EMILE BERGER; G. Masson, Paris, 1892; 457 pages in large octavo, with 43 drawings in the text, and an index. This book is very similar to the previous, and forms a course of lectures delivered by the author (a native of Austria, formerly lecturer at the University of Graz) at Paris, collected by Dr. R. DE SAINT-CYR DE MONTLAUR, revised by the lecturer. The first 70 pages are devoted to a general description of the anatomy, physiology and pathology of the ocular nervous apparatus so far as they give rise to symptoms not exclusively ocular: intra-cerebral and extra-cerebral paralyses of the motor nerves of the eye, centre of co-ordinate movements, conjugate deviation, paralysis of convergence, pupillary reaction, localization of the central lesion according to the functional disturbance of the eyes, and a variety of other conditions. The special part describes the diseases which produce ocular troubles in disease of the nervous system (80 pages), the skin, the ear, the nose and its accessory cavities (39 pages, very good), the mouth and the alimentary canal, the respiratory organs, the blood, the urinary and genital organs, germ diseases, poisoning with a multitude of substances mostly medicinal, trade diseases, hereditary influences, and senility.

We need not say that a book with so extended a scope will be most welcome both for information and reference. It has the advantage over Knies' book of being written in French, a more international language than German. H. K.

3. **Introduction into Ophthalmology** (Einführung in die Augenheilkunde). By Dr. J. HIRSCHBERG, Professor University Berlin, I. Half. Geo. Thieme, Leipzig, 1892; large octavo, 234 pages, very well printed, with 112 drawings. The well-known author describes in this first half of a compendium of ophthalmology, in his original and independent manner: (1) The remedies used in ophthalmology. (2) The operations on the eye (antisepsis (very detailed), anæsthesia, general technique). (3) The examination of the disturbances of vision (10 pages). (4) Refraction, dioptrics and designation of spectacles ("The refractive power of a lens of one meter focal distance has been chosen as a

unit and called dioptry. The idea originated with Nagel, the name with Monoyer; it was introduced by Donders, and objected to by Hasner, Mauthner, and myself"); E. M., and H. (5) Accommodation. The author believes that the latent H which young people show on functional examination, disappears when, in the dark room, they hold their eyes open unconcernedly, and an oculist, skilled in the determination of the refractive state, will detect the whole amount of H without the use of atropine (p. 159). The reviewer, who as long as he has practised ophthalmology has used the direct method as routine work in every case of refraction, is of opinion that in most cases the ophthalmoscope alone suffices, but in some the use of a mydriatic (a 3 or 4 per cent. solution of homatropine) brings out a higher degree of H. (6) Dioptrics. This chapter is excellent and complete, essentially according to the famous § 9 in Helmholtz's *Physiologische Optik.*

Hirschberg's treatise will surely be read with interest and benefit by every oculist. If the author treats the remainder of his subject with the same thoroughness as his chapter on dioptrics, his intelligent reader will be well prepared to understand all ophthalmological literature and to solve new problems which do not lie beyond the sphere of our present civilization. H. K.

4. **A Manual of Clinical Ophthalmology.** By H. F. Hansell, M.D., and J. H. Bell, M.D. 231 pages, small octavo, well gotten up; 120 illustrations. P. Blakiston, Son, & Co., Philadelphia, 1892. This is a very well written, elementary treatise, adapted to the college student and physician who does not want to limit his practice to diseases of the eye. Price $1.75.
H. K.

5. **Ophthalmic Diseases and Therapeutics.** By A. B. Norton, M.D., Professor of Ophthalmology in the (homœopathic) College of the New York Ophthalmic Hospital, etc. Boericke & Tafel, Philadelphia, 1892; 555 large octavo pages, well printed on good paper, with 53 wood-cuts and 12 small colored ophthalmoscopic pictures. This volume has peculiar features. The organic diseases of the eye are described as in the ordinary text-books, and well described, but many subjects of importance—for instance, the whole of refraction and accommodation, both physiological and practical—are omitted. Functional examination (acuteness and field of vision, color-perception, light-sense, eyeball tension, etc., do not seem to have been mentioned)

and even the ophthalmoscope are not described. The two plates of ophthalmoscopic drawings with one page of explanation of the chromo-lithographs appended to the volume appear to have no connection with the text. The illustrations are all reproductions. In the chapter on glaucoma we find beside glaucoma absolutum, glaucoma acut*a*, gl. consecutiv*a*, gl. chronic*a*. The distinguishing feature of the book is the internal treatment of eye diseases. After each disease and its regular treatment, there is, in alphabetical order, a string of internal homœopathic remedies, which are collected and reproduced in Part II. of the work, the ophthalmic therapeutics, taking up one third of the whole space. H. K.

6. **Text-Book of Ophthalmology.** By Dr. E. FUCHS, Prof. University of Vienna. Authorized translation from the second (newest) German edition, by Dr. A. DUANE, of New York. 788 closely printed large octavo pages, with numerous illustrations, mostly original. D. Appleton & Co., New York, 1892. Price $4. This is the English translation of the German text-book, which we have reviewed in a former volume of these ARCHIVES. We can only repeat that it is, in our opinion, one of the very best text-books of ophthalmology, and we desire to add that Dr. Duane has done his work admirably well. He deserves credit and thanks for having made the celebrated Vienna professor's book accessible to English readers. H. K.

7. **Transactions of the Ophthalmological Section of the Am. Med. Assoc.**, at the 43d Meeting, held at Detroit, Mich., June, 1892. This is a neat volume of 367 small octavo pages, containing the numerous papers and discussions of the meeting, reprinted from the *Journal of the Am. Med. Assoc.* It is a great convenience for oculists to have these papers, which, almost without exception, are valuable contributions to ophthalmology, united in a handy volume.

8. **A Handbook of the Diseases of the Eye and their Treatment.** By H. R. SWANZY. Fourth edition, 1892. P. Blakiston, Son & Co., Philadelphia. 580 octavo pages. Price $3. We welcome with pleasure this new edition of one of the standard treatises on the eye. It deservedly continues to be one of the most popular text-books for students and practitioners. The competent author, whose good judgment is apparent on every page, is most zealous in keeping up with the progress of science, of which this new, carefully revised edition bears testimony. H. K.

MISCELLANEOUS NOTES.

APPOINTMENTS.

Prof. Hermann Kuhnt, M.D., has been appointed to the chair of Ophthalmology at the University of Breslau, Prussia, and Dr. Grönouw, lecturer (Privatdocent) at the same university.

Dr. R. O. Born has been advanced from assistant surgeon to surgeon at the New York Ophthalmic and Aural Institute. Many advances from clinical assistant to assistant surgeon have been made at this and other ophthalmic hospitals of New York. The names of the gentlemen are found in the annual reports of these hospitals. All these institutions show a great deal of activity, not only in charitable but in didactic and scientific work.

The same can be said of the institutions of Philadelphia, where Dr. G. E. De Schweinitz, lecturer at the University of Pennsylvania, has been appointed Clinical Professor of Ophthalmology at Jefferson Medical College, with ample clinical and teaching facilities. Similar development exists all through the country. The Archives would gladly record the names if the gentlemen would only favor them with the information.

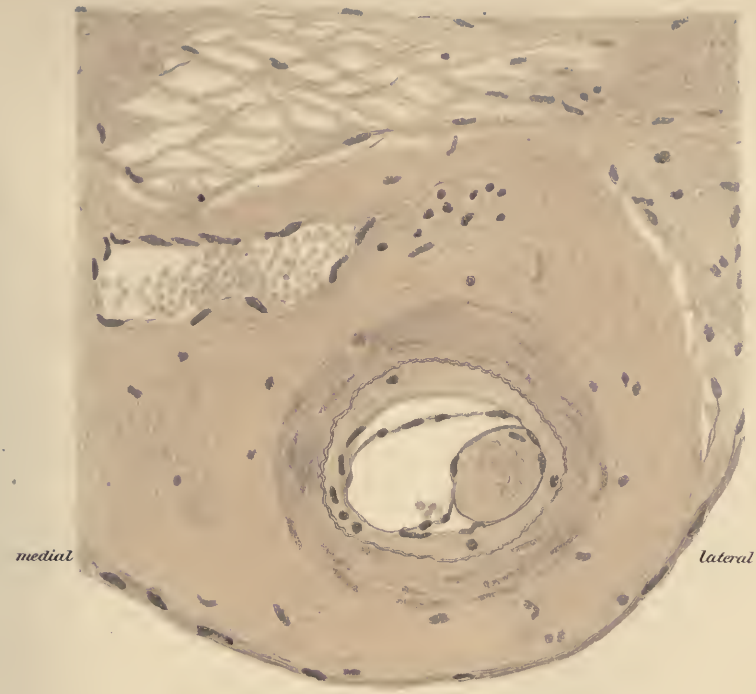
SOCIETY MEETINGS.

The meeting of the American Medical Association will take place at Milwaukee, Wis., on June 6th, 7th, 8th, and 9th. President of the ophthalmological section, Dr. Risley, Phila.; secretary, Dr. Gradle, Chicago.

The Panamerican Medical Congress will be held at Washington, D.C., September 5th–8th. Dr. J. J. Chisolm, of Baltimore, the president of the ophthalmological section, cordially invites all physicians that take an interest in ophthalmology, to attend.

Taf. II.

Fig. 1.



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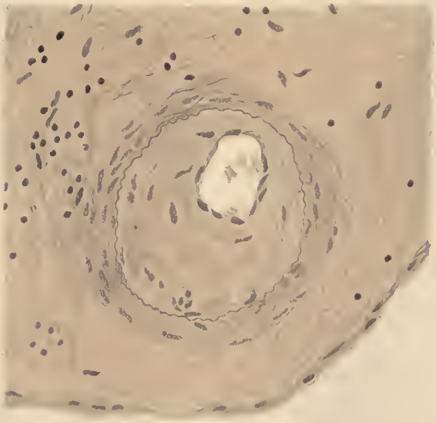

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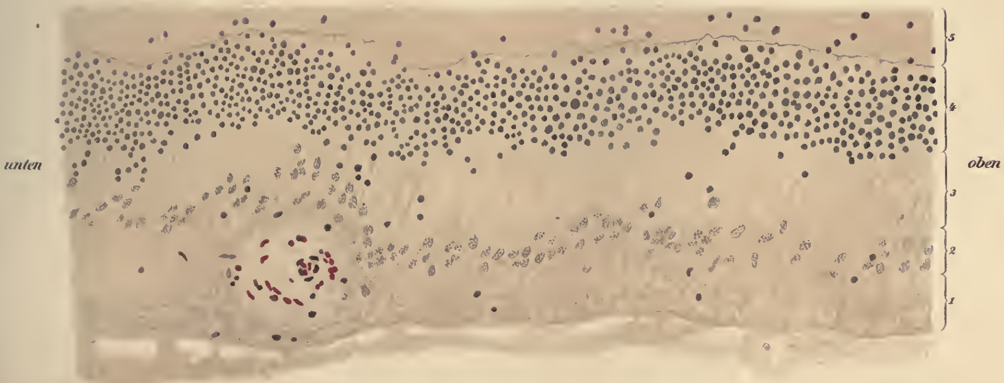

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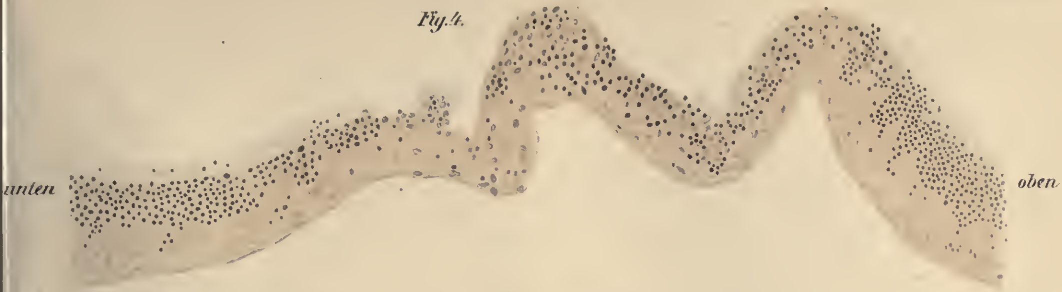
Fig. 4.



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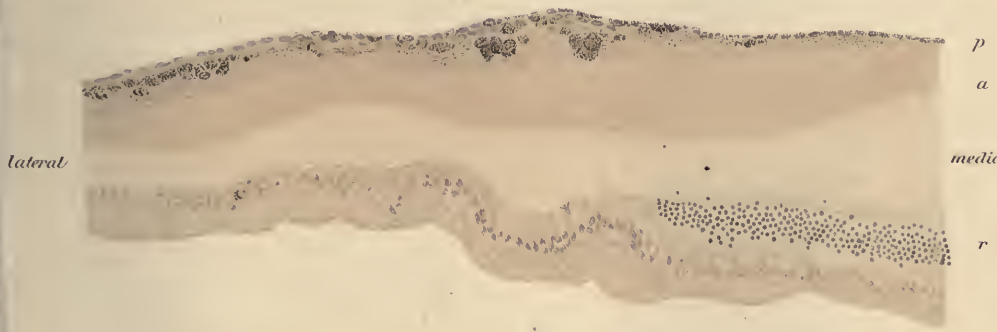

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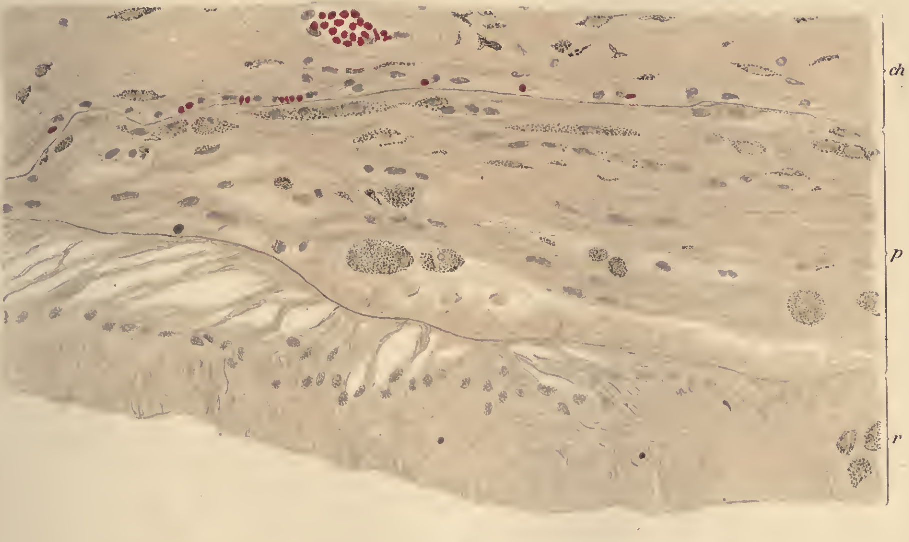
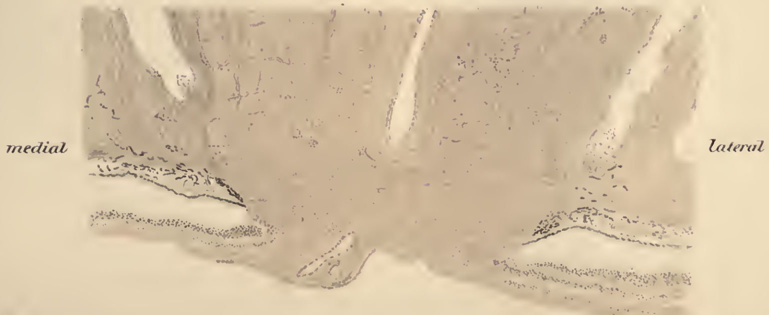


Fig. 7.



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VOL. XXII. No. 2.

ARCHIVES OF OPHTHALMOLOGY.

CLINICAL REPORT OF A CASE OF TEMPORAL HEMIANOPSIA WITH RECOVERY, FOLLOWED BY RIGHT LATERAL HEMIANOPSIA, OPHTHALMOPLEGIA AND PARTIAL RECOVERY.

By H. V. WÜRDEMANN, M.D. and J. S. BARNES, M.D.,
Milwaukee, Wis.

(*With 7 perimetric double charts.*)

March 28, 1892.—L. E. R., æt. thirty-five, American, consulted Dr. Würdemann in reference to sudden loss of vision which he had experienced the day before.

About ten years ago while in Kansas he had contracted quotidian fever which developed into chronic malarial poisoning, continuing for four years. Since then he had been in poor health, being treated for general anæmia by various physicians but obtaining little benefit; going in his despair into the hands of empirics, and also absorbing any quantity of patent medicines. For several months he had been getting worse and at the consultation seemed in a condition of progressive emaciation. Height, 5 ft. 9 in.; weight in winter flannels 129 lbs.; skin sallow; expression anxious; very anæmic; unable to walk more than a block or two for several weeks; pulse at wrist scarcely perceptible; no heart, lung, or kidney lesion, although he had cystitis for years; has chronic atrophic rhinitis which gives him but little trouble; mucous membranes very pale and flabby. He had indigestion with flatulency and constipation; suffered much with insomnia and frontal headache for months; smokes several cigars a day, but seldom takes stimulants; denies all specific history. His father and one uncle died of cerebral apoplexy. Despite his weakness his brain was clear and he had been able to give moderate attention to business. Eyesight previously good.

The day before, had a severe headache and afterwards noticed that his sight was poor although he could still see to read. Also complained of hyperæsthesia of his finger tips and of both legs from the knee downwards. Vision : R, 6-12, Sn. .50 at .25 *m ;* L, 6-24, Sn. .50. Refraction emmetropic. The pupils were moderately dilated, responding to light and accommodation ; hemiopic pupillary reaction marked ; no strabismus or diplopia ; optic discs pale ; arteries much contracted ; veins larger than normal. Examination of the visual fields showed a typical temporal hemianopsia with absolute defect in the temporal halves excepting a clearly marked zone of about 7° around the fixation point in which central vision was preserved. In the nasal halves the color fields seemed contracted especially on the left side whereas form and the white fields were apparently normal. The nasal color fields bore relatively their proper relations to each other, central color vision being normal. There was no disturbance of the sense of locality. (See Figure 1.)

The patient was enjoined to remain perfectly quiet ; hot mustard foot-baths ordered ; blister placed at nape of neck and a saline administered. The next day vision was worse, he being unable to read large print ; had constant dull frontal headache ; pains in limbs ; could retain but little on his stomach ; some retching ; bowels had moved freely and for some days were kept fluid by salines. The hyperæsthesia of the limbs had increased until he complained of the contact of his clothes. On the 31st his condition was indeed pitiable. In the left eye the vision was practically *nil ;* the visual field for form and color being gone, while that for white was contracted almost to the fixation point. There was absolute loss of light sense outside of the central point. (See Fig. 2.)

In the right eye the field for white remained of the same size, although the sensitiveness of the retina was much diminished. The object squares of the perimeter were too small for appreciation so a 1½ *cm* square was used. Although color vision was abolished, sensation for form remained. Vision : R, fingers at 2 *m ;* L, could only see hand when held in line of sight. He had slight vertigo, and felt very weak. Sherry and egg was given morning and night, also weak milk punch several times during the day. A small quantity of rare beef was also taken. 0.30 quinine t. i. d. and sulfonal at night were ordered.

During the next four days there was a decided general and

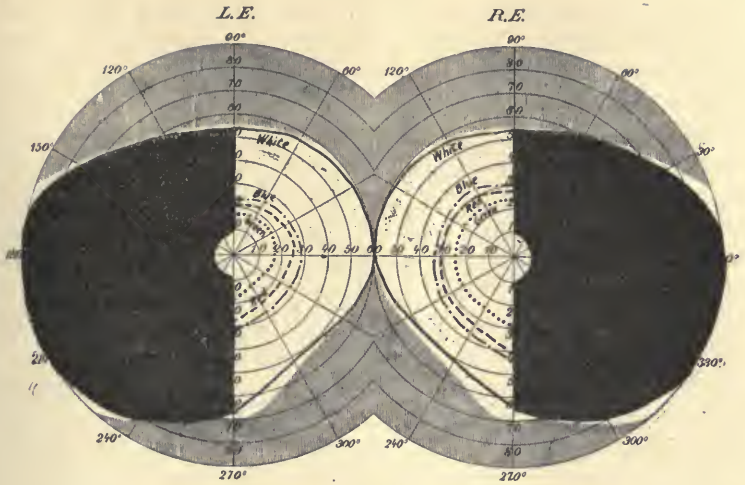

FIG I.

Temporal hemianopsia with contracted color fields in nasal halves and preservation of central vision. First attack.

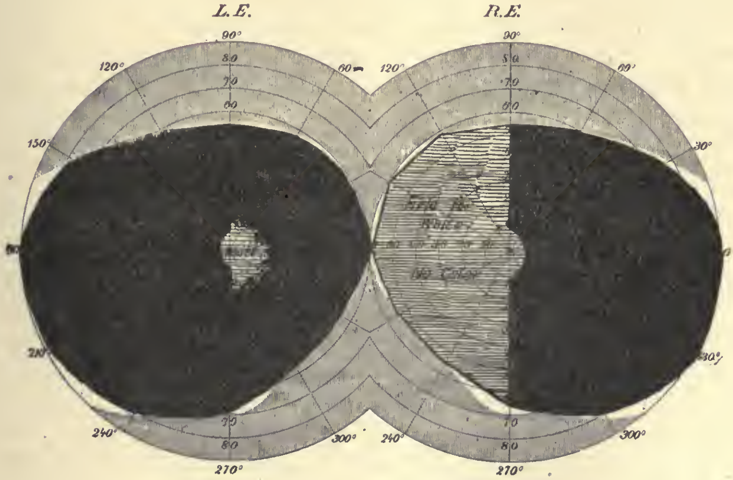

FIG 2.

Temporal hemianopsia for form and white; colors abolished; great contraction of left field.

visual improvement; when the field was again taken the central vision had returned on the right side and the small white square of the perimeter could be seen as a pure white. In the left the central area of quantitative vision seemed larger although appreciation of color was absent and white looked dirty. Sensation of form had returned. The hyperæsthesia of the lower limbs and finger tips had given way to numbness. He said "that he could not feel his feet." On the 6th of April, the local and general improvement was even more marked: No more headache; he slept better with the aid of sulfonal; the anxious look had left his face; the pupils were yet dilated, but responded slowly to light over the whole visual field of the right side. With the exception of an apparently much enlarged blind spot, white could be seen over the whole field. Hemianopia for color still remained and central vision was about the same. In the left eye, the defect was much less although distinctly hemianopic in character. Central vision was reduced even more than on the 30th of March, but white could be seen as clean white in the nasal half. On the 13th of April, the visual fields were as is shown in Fig. 3.

On account of the increasing central scotomata axial vision was abolished in both eyes, being reduced to the counting of fingers at one metre for both sides. An iron tonic and K I in gradually increasing doses to 4.00 a day was given in essence of pepsin. He was put upon a nitrogenous diet with meat three times a day. Two weeks later there was great improvement. He had gained 15 lbs. in weight. His appetite was good and bowels regular. The numbness of finger tips had increased to anæsthesia while that of the feet and limbs was passing away. Vision: R, $\frac{6}{60}$; L, fingers at 1 *m*. Pupils somewhat dilated, with slow response to light and accommodation. Central vision for white had returned in right, but there remained a scotoma for red, the field of which was peripherally contracted. Green was not recognized. In the left, the field had cleared, as is shown in Figure 4. In this eye there was an absolute central defect and the edges of the field were well defined.

About this time, in addition to the dietetic, tonic and alterative treatment, general massage was instituted. On May 4th, he weighed 149 lbs., and could walk a mile without fatigue. He could then read large print. Vision: R $\frac{6}{23}$, L $\frac{6}{60}$. The pupils were normal in size responding to light and accommodation. The optic nerves were pale and somewhat atrophic. The right

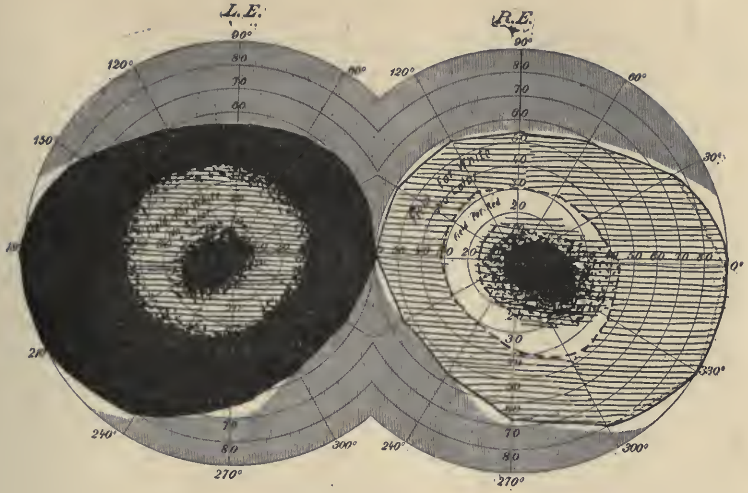

FIG 3.

Central scotomata forming.

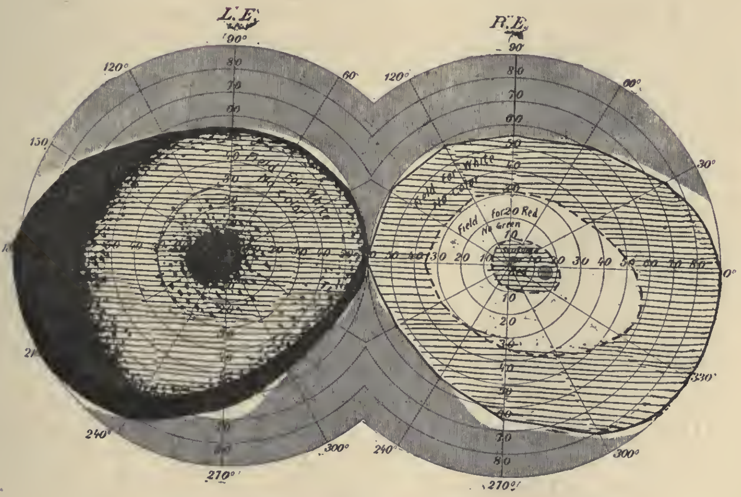

FIG 4.

Central scotomata disappearing.

visual field was normal for white, while the color fields were greatly contracted. There was a small central scotoma for red and a larger for green. The fields for green in both eyes were relatively more diminished than for the other colors. (See Fig. 5.)

About the last of May the patient did not feel so well, had indefinite parasthesiæ, and was depressed in spirits. On examining the visual fields by the perimeter we were surprised to find that the limits of the color fields were poorly defined, and that they overlapped each other indiscriminately. The boundaries varied at times in such a manner that no reliable drawings of the fields could be obtained. He was told that there was not much more improvement in vision to be expected, but that any beneficial change in the general health might have its influence toward more restoration in vision. Accordingly an ocean voyage and sojourn in an equable climate for several months was recommended. May 27th, he departed for the Bermuda Islands. While in New York, he consulted Dr. H. Knapp who gave him the same prognosis.

He arrived in Bermuda in good spirits, and wrote in the early part of June that the trip had benefited him greatly, and that his vision was "steadier." We heard later that he had an attack of dysentery, and was fearful of a return of the old malaria. On July 21st, we were disagreeably surprised to receive a cablegram, stating that he was seriously ill and was on his way home. He arrived with his wife on the 26th. She said that he had been suffering from dysentery for two weeks, and several days before their departure had evinced signs of loss of reason. He had insomnia and hallucinations of sight and hearing, which had not been controlled by chloral and bromides administered by a Spanish physician, who had attended him there. He had several fainting spells with vomiting and headache. On the sailing day of the boat he had noticed that the left upper eyelid drooped, and he stumbled over objects in walking. He had complained of his eyes for several days previously. He arrived in Milwaukee in a stupid condition, and does not remember anything of the passage home.

He was seen at his residence, lying on a lounge in a comatose state. When disturbed he would wake up, but would not recognize any one and again relapse into the former apathetic condition. During the week of the journey he had taken little nourishment and was consequently emaciated. Skin was sallow; pulse had

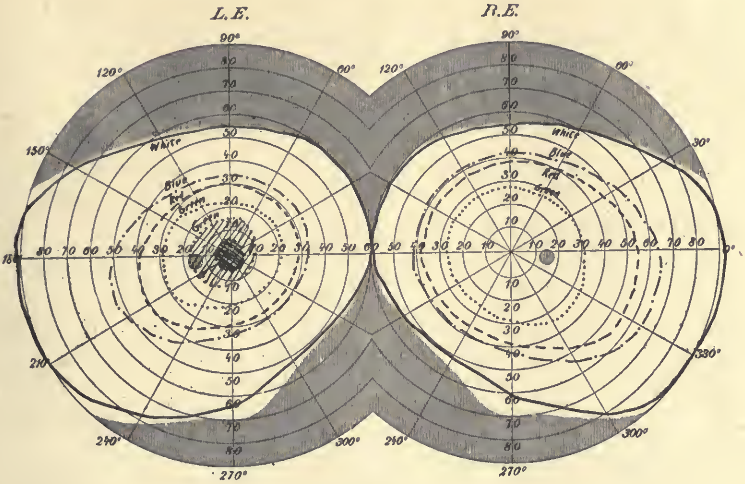

FIG 5.

Resulting vision after convalescence from first attack. Central scotomata for red and green in left.

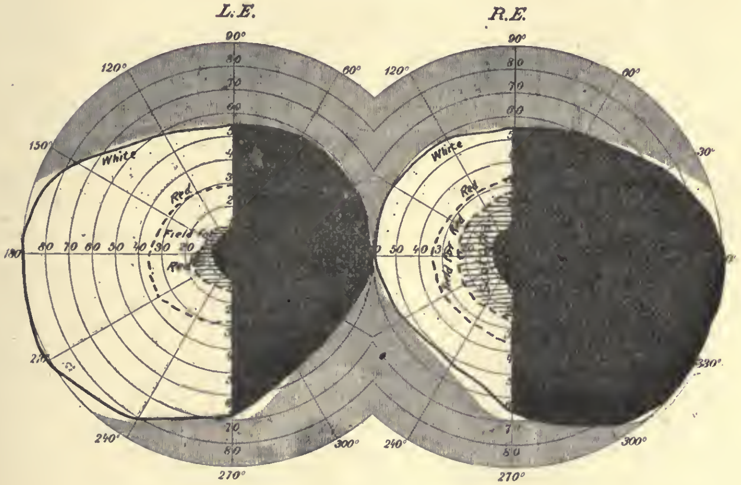

FIG. 6.

Right lateral homonymous hemianopsia; obliterated central vision and large central scotomata for red. Second attack.

been full and hard, but was now thready and weak; bowels had been constipated during the entire journey. He was lying with eyelids of both eyes partly closed. When aroused from the stupor it was seen that there was paralysis of left internal rectus and left ptosis. The pupils were dilated and immovable. Ophthalmoscopic examination showed veins very much enlarged and tortuous and the arteries apparently contracted; no evidence of papillitis or retinal hemorrhage. He said that he could not see the light when held close to either eye. There seemed to be no defect of speech other than what would be expected from one in such a condition, and no paralysis other than ocular was found. The same treatment, ordered at the time of the other apoplectic seizure, was given and his condition improved in a few hours. Dr. J. H. McBride was called in, and the conclusion arrived at as to recovery was unfavorable.

On the next day he was rational and could see a strong light when directed from the left. Wernicke's symptom could not then be obtained. In two days there was considerable improvement, and then hemiopic iris contraction was marked. August 4th, the visual field was carefully taken by the perimeter. (See Fig. 6.)

There was absolute defect of the right sides of each field, and central vision for about 10° in the left halves was likewise abolished. There were large central scotomata for red. Green could not be seen, and blue was not tried. Dividing line was exactly perpendicular in each field. Pupils dilated; hemiopic pupillary contraction marked; external squint less in degree; ptosis the same as at first. Vision: R, fingers 1 *m*; L, fingers ½ *m*. Diplopia present, but owing to the diminished visual acuity it was not troublesome. A few days later, a nitrogenous diet, large doses of iodides, and iron with stimulants were again administered.

August 29th.—When the patient had gained somewhat in strength he weighed but 125 lbs. Slight ptosis remained but the squint and diplopia had disappeared. Wernicke's symptom could be elicited with difficulty. Vision: fingers at 1 *m.* both eyes. Colors returning to nasal half of right field, and a few days later to temporal half of left. The defect for both sides was now only relative although large absolute central scotomata remained. In the hemianopic areas a 1½ *cm* white square could be distinguished but not the size commonly used with the perimeter. There was no disturbance of the sense of locality. The lamina cribrosa of the whitened optic discs could be distinctly seen. Massage and salt baths were begun in addition to the other treatment. The vision gradually increased until Sept. 21st he could read the headlines of a newspaper with the right eye. He slept well without a hypnotic and headaches had disappeared. His weight was 149 lbs. A course of strychnine injections was then begun and pushed to his systemic limit (.03 at a dose). Tonics were given later and the iodides dropped for a while, being taken up again. He has since made several trips to Dakota with the view of establishing a business.

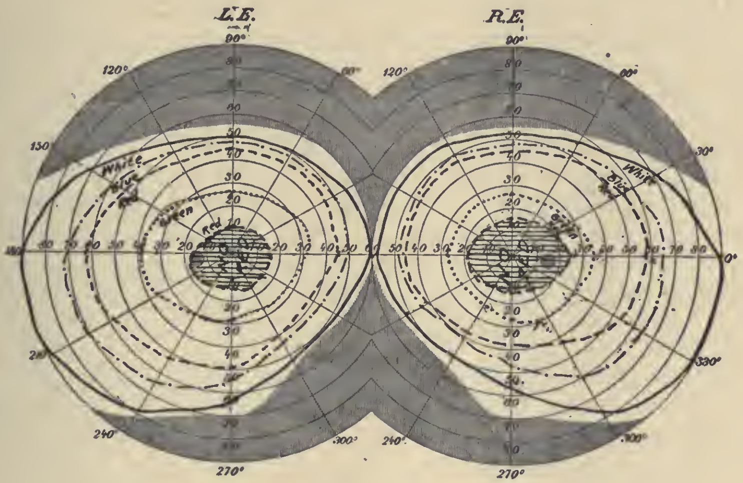

FIG. 7

Resulting vision after convalescence from second attack. Central scotomata for red, none for green.

December 20th.—He weighed 169½ lbs. in his overcoat (about twenty pounds more than he had ever weighed); could take any amount of exercise; memory good, and he was very anxious to get back to work; eyes straight; no ptosis; pupils normal; nerves slightly atrophic; Vision: R and L, $\frac{6}{60}$, with plus 2.00 read Sn. 1.50. (The enlargement by the glass helps him greatly so that he is enabled to decipher his correspondence with comparative ease.) The visual fields seemed contracted above and below for white, but this was probably due to limitation of the angular aperture of the lids by frowning in the endeavor to see distinctly. The fields for red and blue seemed normal while for green there was a marked contraction. There were large central scotomata for red but none for green, which was perfectly distinguishable over the whole of its field. (See Fig. 7.)

This case has been reported in full as it is believed to be of interest on account of the uncommon occurrence in two distinct apoplectic attacks of the different forms of hemianopsia with peculiar changes in the central vision. The minuteness with which it was studied during the whole course by two observers verifying one another's work, gives a certain value to the report. The original lesion is believed to have been miliary aneurisms at the base of the brain, due to an atheromatous condition of the vessels engendered by the years of general anæmia. The first apoplectic attack was apparently due to a circumscribed hemorrhage at the anterior portion of the optic chiasm pressing upon the decussating fibres, thereby producing temporal hemianopsia, the clot afterwards being absorbed, but not before pressure on the optic nerve resulting in partial atrophy had occurred. The almost complete restoration of the visual fields under treatment is unusual. The erratic changes in the visual fields with the paræsthesia and mental disturbance that followed were not recognized at the time as prodromes of a second attack; the cause of which was probably debility resulting from the dysentery. At this time the hemorrhage was more posterior, involving the whole of the left optic tract and for a short time affecting the third nerve of the same side as is shown by the evanescent external squint and ptosis. No explanation of the peculiar changes in central vision and of the condition of the color fields is offered. The remarkable gain in general health may be reasonably ascribed to the method of treatment and avoidance of the "isms" and "pathies" to which he had previously been a victim.

Subsequent History to March 19, 1893.

The patient has not taken medicine for two months, and considers himself perfectly healthy. He has attended to all the requirements of his business during this period. In fact, he approached me to-day about his qualifications for obtaining life insurance. He weighs over 170 pounds in his winter flannels. Continues baths, diet, and systematic exercise. There has been further improvement in sight, and he has discarded the use of the magnifying lenses except for fine print. Uses his eyes moderately. Vision: R $\frac{6}{24}$, L $\frac{6}{30}$, Sn. .60 at .25. White is well seen over entire area of both visual fields. Scotoma for red in left is about the same as in Fig. 7, taken December 20, 1892, while that of the right is hemianopic, the temporal field being wanting until the periphery is reached, where red is again seen. In both there remain central scotomata for red. The central vision for green is preserved, though its area is much contracted, occupying positions of the central scotomata for red. All colors in periphery of fields are well-defined. He notices an oscillation of his eyes when looking intently at small objects. This may be due to minute central scotomata for form and white, but which are too small for objective demonstration. This may be so as is exemplified by the state of the vision for red. On account of the central scotomata for this color he is red-blind in direct vision, but when the eyes are rolled he can distinguish the various shades of red. Sometimes the red color of small objects suddenly dawns upon him even after he has not appreciated their color for several minutes. Red in large masses is quickly perceived. Optic discs seem white and atrophic.

A REPLY TO DR. C. E. FINLAY'S CRITICISM OF MY INVESTIGATIONS AND VIEWS ON THE ORIGIN OF SYMPATHETIC OPHTHALMIA.

By ROBERT L. RANDOLPH, M.D.

ASSISTANT OPHTHALMIC AND AURAL SURGEON TO THE JOHNS HOPKINS HOSPITAL; SURGEON TO THE PRESBYTERIAN EYE AND EAR HOSPITAL, BALTIMORE.

IN the supplement to his interesting and valuable article on penetrating wounds of the eyeball, etc., in these ARCHIVES, October, 1892, Dr. Finlay makes certain criticisms concerning an observation which I have recorded in these ARCHIVES, vol. xxi., No. 3, and concerning my conclusions as to the bacterial origin of sympathetic ophthalmia. To these criticisms I beg to make the following reply.

The observation in question is one which I made with negative result—a bacteriological examination of an eye affected with traumatic irido-cyclitis, removed at a time when the inflammation was still active, and when sympathetic ophthalmia had made its appearance. A portion of the inflamed iris was inserted into the anterior chamber of a rabbit's eye without causing inflammation either of this or of the opposite eye. Dr. Finlay says (p. 495 and 496): "The value of this negative result is somewhat lessened by the following facts: (1) the length of time which had elapsed since the injury, the eyeball being enucleated two and a half months later, it being very possible that the micro-organisms had already been destroyed by their own products, notwithstanding the fact that the process was still active at the time of the enucleation; (2) the limitation of the bacteriological investigation to the iris and aqueous chambers; (3) the absence of a histological or of a histo-bacteriological examination."

Ad. (1): The possibility that micro-organisms may have been present at an earlier stage of the inflammation and have disappeared at the time of the enucleation cannot, of course, be denied. Against this view it may, however, be urged that pyogenic bacteria have been demonstrated in traumatic inflammations of the eye at a much later period after the injury than in this case, and that the inflammation was still active. As has been shown by Leber and others, inflammations subside with the disappearance or death of the bacteria causing them. Dr. Finlay's objections would have greater force if my observation were an isolated one, but we already possess a considerable number of similar negative bacteriological examinations of eyes removed after the appearance of sympathetic ophthalmia, and it is only cases in which sympathetic ophthalmia has already been produced that can be utilized for determining the question as to the bacterial origin of the disease. The following may be mentioned as having reported negative results from the bacteriological examination of eyes affected with traumatic inflammation removed during the existence of sympathetic ophthalmia: Nordenson, Ayres and Alt, Pflüger, Schmidt-Rimpler, Haab, Sattler, Greeff, Uhthoff, Berry, Kuhnt, and Schirmer.

Ad. (2): Dr. Finlay is mistaken in saying that my bacteriological investigation was limited to the iris and aqueous chambers; as stated in my article, page 368, cultures were also made from the posterior chamber (in the preceding paragraph I had already stated that everything was ready to make cultures from the vitreous and anterior chamber of the eye), and cover-slip preparations from the vitreous and anterior chamber were also examined.

Ad. (3): I regret that I did not include in my article a description of the histological changes which I observed on microscopical sections. I still have the notes of these changes and I became aware of the omission after sending the proof of my article. I take this opportunity to add that microscopical sections showed the customary lesions of traumatic irido-cyclitis: hemorrhages in the choroid and retina, dense small-celled infiltration of the uveal tract, especially of the anterior part, with considerable round-cell infiltration of the papilla, which infiltration, however, could not be traced more than a short distance along the stump of the optic nerve. There was beginning organization of the exudate on the surface of the iris and ciliary processes. Sections were stained in the usual way with various aniline dyes, but no bacteria were found.

It is, however, clear from my article that I did not rely exclusively upon cultural methods to determine the presence of bacteria. Cover-slip preparations were smeared with the fresh tissues and exudates, and in my experience such preparations often afford readier demonstration of bacteria in diseased tissues and exudates than do microscopic sections. In addition to cultures and the examination of cover-glass preparations, a test was made by inoculating a rabbit's eye with a good-sized piece of iris. No inflammation developed, which would hardly have been the case had the iris contained living pyogenic bacteria. Dr. Finlay says: "The series of negative results of different observers quoted by Dr. Randolph are of undoubted value, but positive results even if fewer in number have a much greater importance." I am not able to agree with this statement so far as the question of the origin of sympathetic ophthalmia by any bacteria at present described—and especially by the ordinary pyogenic cocci—is concerned, and in this view I am strengthened by Schirmer,[1] who is convinced of the infectious origin of sympathetic ophthalmia and who, after quoting most of the negative results above enumerated, says: "These observations, if made with the necessary care, must naturally have greater weight than the positive results which were obtained by Deutschmann, Limbourg and Levy, Angelucci, Basevi, and Sattler; for if micro-organisms are the cause they must be present in all eyes giving rise to sympathetic ophthalmia.

The occasional demonstration of pyogenic bacteria, in traumatic inflammations of eyes, removed during the existence of sympathetic ophthalmia, has nothing surprising about it, but this demonstration does not warrant the conclusion that the sympathetic inflammation is due to the same bacteria, and in the light of the many negative results does not justify the opinion that these bacteria produce those changes in the injured eye that lead to sympathetic disease. Still less can positive results from injured eyes removed in cases without any sympathetic ophthalmia, and Dr. Finlay's positive bacteriological results were all of this class, outweigh negative results from eyes removed in cases of co-existent sympathetic ophthalmia. Dr. Finlay charges me with failing "to take into account the experiments of Knapp and Leber, on the aseptic or septic condition of wounds and the instruments producing them, and of foreign bodies lodged in the interior of eyeballs, in relation to their liability to produce inflammation and sympathetic ophthalmia." This charge is based upon a misunderstanding as to the purpose of the work which I have published as to the pathogenesis of sympathetic ophthalmia. I have not considered the general question as to the microbic origin of traumatic inflammations of the eye. I have nowhere expressed hostility to the doctrine of the infectious origin of sympathetic ophthalmia as such. I have made a large number of experiments to test the results reported by Deutschmann, and I have not been able to confirm the experimental and bacteriological conclusions reached by him and upon which he bases his argument, nor has any one else been able to satisfactorily confirm Deutschmann's experiments and observations on these points, so that there is now a growing general belief that he fell into serious errors of observation and of interpretation. Schirmer who adduces in his recent exhaustive article every available argument in support of the infectious origin of the disease is forced to the conclusion that this affection is not caused by any known pyogenic bacteria and that it has not been satisfactorily produced experimentally. As my purpose in the article published has been simply to test the experimental and bacteriological evidence brought forward by Deutschmann and others, and not to discuss the general question as to the infectious theory of sympathetic ophthalmia, I have not found it necessary for this purpose to quote the important experiments of Knapp and Leber.

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[1] *Von Graefe's Archiv f. Ophthalmologie*, Bd. xxxviii, Abth. 4, p. 234.

As my conclusions are in such conformity with those of Schirmer, I may here be permitted to quote the position taken in my article in these ARCHIVES vol. xxi., No. 3, p. 375. "I do not wish to be regarded as absolutely arrayed against the infection theory, but against the theory only so far as the pus organisms are concerned. There are many organisms about which we know nothing, with which it might be possible to produce the disease in animals; and again sympathetic ophthalmia may have its own specific organism. It is possible, too, that the disease is not of bacterial origin, but that an organism of some other class may be present; and again we have strong reason for believing that the lower animals do not have sympathetic ophthalmia, just as they do not have other diseases peculiar to the human race." It will be remembered that it is exactly the ordinary pyogenic staphylococci upon which Deutschmann and his followers lay the chief stress as the infectious agents of the disease, and it is against this view that most of my work has been directed. I am at a loss to understand what Dr. Finlay means by the last sentence of his article: "With regard to the purely theoretical arguments advanced by Dr. Randolph against the staphylococcus pyogenes aureus in particular, they fall to the ground before the positive results quoted, as well as those detailed in this paper." If Dr. Finlay means that I do not suppose that the staphylococcus pyogenes aureus is capable of causing inflammation of the eye, I am certainly the last one against whom such an accusation can be brought in view of the large number of experiments which I have made and published, showing its power in this respect. If he means that I do not consider that there is any satisfactory evidence that this coccus can produce sympathetic ophthalmia, I admit that this is my opinion, but he should not call my arguments "theoretical," as they are based upon observation and experiment, and are confirmed by many others, nor do these arguments fall to the ground before Dr. Finlay's positive results which do not bring a particle of evidence that the staphylococcus pyogenes aureus can produce sympathetic ophthalmia. Dr. Finlay's own observations are interesting as to the nature of traumatic inflammations of the eye, but they shed no light whatever upon the origin and nature of sympathetic ophthalmia. His observations do not include the bacteriological examination of any eyes removed during the existence of sympathetic ophthalmia. This affection is an exceptional occurrence as the result of injury and traumatic inflammation of an eye, as appears strikingly from Ohlmann's analysis of Schweigger's material, in which out of 556 severe injuries sympathetic ophthalmia occurred only twice. This fact alone would indicate that an infectious agent causing the disease is probably not identical with the ordinary pyogenic cocci found by Dr. Finlay and many others in traumatic inflammations of the eye. To me the surprising thing is that Dr. Finlay should have failed to demonstrate bacteria in so many cases of traumatic inflammations including fresh suppurative forms, rather than that he should have found them in some cases. In the present state of the question as is now generally recognized, the mere demonstration of pyogenic bacteria in a series of traumatic inflammations of the eye without the existence of sympathetic ophthalmia cannot be utilized in discussing the specific cause of the latter disease, and this becomes all the more evident where there are so many negative results as in Dr. Finlay's series.

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By CHARLES A. OLIVER, M.D.

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The preparation of the card has been given to Mr. William S. Yarnall, of 1406 Chestnut Street, Philadelphia of whom copies can be procured.

D-XL

E O

D-XXXV

C F D

D-XXX

L O E

D-XXV

D F C L

D-XX

T D E O F

D-XV

O L C F D

D-X

F D E C L

D-VIIa

C T O E D F

D-V

E O F C T D L

OPHTHALMIA NODOSA, CAUSED BY PENETRATING CATERPILLAR HAIR.

By Dr. E. KRÜGER, of Bonn.[1]

Translated by Dr. C. ZIMMERMANN, Milwaukee, Wis.

(*With Plate IV., vol. xxiv., Germ. Ed.*)

IN the course of two years (1890–1892) at the eye-clinic of Bonn, four cases of a peculiar and rare disease were observed, for which Prof. Saemisch suggested the name *ophthalmia nodosa.* It was characterized by multiple small nodules in conjunctiva, sclera, and iris, caused, as could be proven with certainty, by penetrating caterpillar hair, and associated with violent iridocyclitis and deep corneal infiltrations.

Case 1.—A healthy peasant-girl, aged twenty-three, came on January 6, 1891, stating that her left eye was inflamed since the end of September, 1890, without apparent cause. During that time the inflammation had several times increased with severe pain, abating after about two weeks. The last two weeks she had a more intense relapse. The right eye being perfectly normal, the left shows intense pericorneal injection, moderate photophobia, and is painful in the ciliary region to the touch. The cornea is slightly hazy from a parenchymatous inflammation and in its deepest central layers there is a striated infiltration, 2 *mm* long (in the vertical direction) with indistinct outlines. At the lower margin two smaller ones, superficial, well defined, and vascularized. Two grayish-red cyclitic exudations, of the size of a pin's head, lie in the lower sinus of the anterior chamber. In the hyperæmic and discolored iris are three small yellow-gray nodules at the lower pupillary margin, and below these a similar larger prominence in the region of the minor circle. This portion of the pupillary margin is adherent. On the anterior capsule fine exudations. Vitreous clear. $V = \frac{20}{70}$—. The patient was admitted on the same day, and the irido-cyclitis treated with antiphlogistics (atropine, moist heat, blue ointment). The ciliary injection and corneal opacity increased however. Hardly any reaction to atropine. A fresh exudation formed in the sinus of the anterior chamber. A new, fifth, nodule developed on the iris next to the others, and the pain became unbearable. This, as well as the injection, was at once relieved by Heurteloup's artificial leech (January 11th). On January 18th, ten miliary yellowish-white nodules appeared under the ocular conjunctiva below the cornea, with exacerbating inflammatory symptoms. They were oval, roundish, 1-1.50 *mm* long, prominent, arranged in three groups of 3 or 4, looking white under the injected conjunctiva, in part (4) adherent to the sclera, in part (6) movable with the conjunctiva. After three days two more sprung from the upper medial corneal limbus. They grew a little larger, but not exceeding 2 *mm* in length. The nature of these nodules remained unexplained at first, since their tough consistence, their location, and the absence of other symptoms were against a tuberculous eruption. January 23d, two subconjunctival and one scleral nodule were removed, hardened in alcohol, stained with hæmatoxylin, and mounted in celloidin. In sections they showed a great resemblance to tubercles, consisting mostly of an accumulation of round cells, interspersed with non-vascular, scanty connective tissue, and surrounded by connective tissue infiltrated with a few cells, without a special capsule. In the centre of the nodule were several giant-cells with numerous large, not marginal nuclei, few epithelioid cells, and between them a yellow foreign body with two oval sections, a central cavity, and a yellowish cortical substance, corresponding, on the whole, to the oblique section of a hair. As the latter could, in all probability, be only a caterpillar hair, the patient was questioned in that respect. Finally she remembered that, on the 26th of September, when she first noticed the pain in her eye, her sister had thrown a black-brown caterpillar, in a rolled up state, against her left eye, while she was busy with hay-making on a meadow in the woods. She did not pay any attention to it, but rubbing caused slight pain, which became more severe towards evening. The next day the left eye was very much inflamed.

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[1] From the University Eye Clinic at Bonn.

According to the description, season, and locality, it could be only a caterpillar of the species *gastropacha rubi*, very common in autumn on meadows in the woods. We know that their hairs, when penetrating the epidermis, cause itching, erythema, and urticaria. A specimen, accidently on hand, was identified by the patient as the same by which she had been injured. This caterpillar, which, from August to April, may be found on various low plants, attains a length of 7–9 *cm*, is black, and has tufts of long dark-brown hair, and on its back a band of short tough rust-colored hair with black transverse indentations. Under the microscope the hairs appear light-yellow and have a central lumen, one third of their diameter wide, ending in a sharp, short point. They are covered by scales, arranged in the form of shingles, terminating in hooks which are turned towards the root of the hair. These hooks, preventing any backward movements of the hair, when it has once penetrated the skin, are wanting in the darker ones, which have larger lumina and exceedingly thin and long points. The hairs found in the nodules were identical with the short, light hair in color, size (0 03–0.04 *mm* wide), and shape, and in most sections their margin appeared to be eroded. Possibly the scales had fallen out of these irregular roundish indentations in consequence of the preparation, as similar changes were found in sections of these hairs which had been prepared differently.

In regard to the further course, this case showed very frequent acute relapses. In intervals of four to twenty days, in which the eye was almost without irritation, generally at night an exacerbation of the inflammatory symptoms set in, under intense pain, lasting for a while. No other immediate cause could be ascertained, but several times a protracted examination or clinical demonstration. During these attacks, the cloudiness of cornea and aqueous humor increased, and the nodules swelled somewhat. The striated corneal infiltration advanced upwards nearly to the upper limbus in a few weeks. Then it divided into several portions, in one of which a thin yellow thread became visible deep in the substance, which undoubtedly was a penetrating hair. In these attacks Heurteloup's leech was very efficacious (except once), the inflammatory signs abating promptly on the second day. After six months the relapses became less frequent, the nodules grew flatter and smaller and more yellow and transparent. From time to time however a very painful inflammation of longer duration occurred, the last May 9th. On this Heurteloup's leech had no effect (May 17th), but after six natural leeches (May 25th) the inflammation subsided in a few hours. The left eye has remained free from irritation ever since. The conjunctival and scleral nodules in part disappeared entirely in the three subsequent months, in part left some small yellow or gray spots (the latter near the limbus). The striated infiltrations of the otherwise clear cornea were transformed into maculæ. The yellow hair in one of them could not be seen any more. Only one of the nodules in the iris is still marked. Synechiæ unchanged. Pupillary exudations thinner. The media being clearer now, opacities of the vitreous and an oval atrophic focus, lined with pigment, can be discerned in the choroid downwards and outwards near the ciliary body. The affection, taking a relatively favorable course under simple antiphlogistic treatment, may thus be considered as permanently cured.

Case 2.—A man of twenty-six years, presented a similar picture, suffering from a painful inflammation of the left eye since September 14, 1891. On the previous day he worked in a field of oats and in the afternoon, while resting on straw in a barn for some time, he had the sensation as if some straw had entered his left eye. The next day the eye was very much inflamed. At the first examination (Nov. 5th), seven weeks afterwards, a violent iridocyclitis was discovered with intense ciliary injection, discoloration of iris, synechiæ, and cyclitic exudations in the sinus of anterior chamber. Besides, the iris exhibited some fine reddish-yellow spots and striæ near the ciliary border. $V = \frac{20}{40}$ —. The patient was admitted Nov. 5th, and treated in the same manner as the first, but without result. But after the application of six leeches (Nov. 10th), the inflammation gradually subsided. During that time (Oct. 21st), a pupillary exudation formed, and Dec. 1st thirteen nodules were observed under the ocular conjunctiva, perfectly similar to those described above. Except two, they were located between cornea and the lower fornix, nine on the sclera, four in the conjunctival tissue. Although tuberculosis could not very well be assumed in this case either, 1 *mgrm* tuberculin was injected on Dec. 4th, but without reaction. Jan. 16th the patient, being a little better, was dismissed upon his request. Four weeks later (Feb. 17th) he was again admitted. In the meantime the inflammation had become severe several times. The condition was about the same as when he left. The nodules, persisting in the same number, apparently had become smaller. In the cornea a deep exudation in form of a vertical stripe, which was approached by some blood-vessels from the margin. In its centre a fine brownish-yellow thread could be perceived. The fine spots in the iris were more prominent and had a more gray color, the synechiæ more numerous, and the exudation on the anterior capsule denser. As hairs were found in the nodules of the first case, the same cause was supposed to exist in this one, and was verified by the examination of three nodules, excised on Feb. 23d. The patient only remembered that he had seen many large brown caterpillars at that time, but did not know whether one had come in contact with his left eye.

Plate IV. (1:100) shows such a preparation made by Dr. Caspar. It represents, in subconjunctival tissue, a nodule without capsule, consisting of round cells. In the centre it contains, between four giant-cells, a yellow ring, the cross-section of the hair with a central lumen, a yellow cortex, and roundish indentations at the margin. From the above reasons, it can hardly be doubted that it is a hair of *gastropacha rubi.*

Case 3.—Jacob Esser, a boy of five years, was seen Feb. 21st, 1892. The left eye was perfectly normal. Right eye: severe iridocyclitis with intense ciliary injection, exceedingly narrow pupil, and almost complete seclusion and occlusion, as observed after perforating injuries. The diagnosis was determined by numerous nodules under the conjunctiva and in the iris. Twelve nodules, ½ *mm* long, were found between corneal limbus and lower fornix, located partly in Tenon's capsule, partly in the uppermost layers of the sclera (3), three under the conjunctiva of the lower lid, of which two were seated so deep that they became perceptible through the external skin when the lid was slightly stretched. From the minor circle of the iris three folds, like pockets, ran downwards, in the bottom of which, near the sinus, four oval nodules were situated, seemingly 2 *mm* long, with smooth surface and of the same color as the iris. The iris-periphery was slightly bulged forward. No red reflex. $V = \frac{3}{500}$. Tension minus. The parents noticed the inflammation since Oct., 1891, which did not seem to be painful, but they could not state anything in regard to the cause. The microscopical examination of two episcleral nodules showed the same picture described above. This case ended unfavorably. Atropine remaining ineffectual, as might be expected on account of the occlusion of pupil, iridectomy was performed March 4, 1892. A narrow, but complete coloboma downwards was obtained and the largest nodule removed with the iris. Healing without disturbance. The injection decreased, and $V = \frac{10}{500}$. But after fourteen days the injection increased, the pupil became smaller and covered by exudation, iris bulged forward. After four weeks, detachment of retina. Decrease of tension, $V = \frac{15}{2000}$, so that the eye could be considered as lost. The excised piece of iris was filled with lymphoid cells and irregular exuberant pigment-cells. No fragments of a hair could be found. Probably the portion of the nodule containing the hair remained in the eye.

CASE 4.—Gabriel Fink, æt. thirteen, was observed March 12, 1892. Since September, 1889, he suffered from a constantly recurring, moderately painful inflammation of his right eye, without known cause. At the end of 1889 he had been treated in this city as an outdoor patient for keratitis superf. vasc. and iritis serosa, with doubtful diagnosis, for a few weeks. At the first examination (March 12, 1892) a roundish macula (2 *mm* in diameter) was observed at the upper external limbus, with slight pericorneal injection, spongy exudation at the lower sinus, and a peculiar affection of the iris. It was a dark, almost horizontal, furrow, 7 *mm* long, 1.50 *mm* wide above the minor circle, commencing in the middle of upper and outer quadrant of the iris, and terminating at the nasal angle of the anterior chamber with a yellowish-gray nodule 2 *mm* long, in connection with a white thread. Pupillary exudation, numerous synechiæ, on one of which a nodule was seen. $V = \frac{20}{200}$. Fundus visible, optic disc hyperæmic. A diagnosis was not arrived at until, at the second examination, 16 minute yellow-gray nodules, hardly prominent, were detected, which required great attention and good daylight. The nodules, 1 *mm* long, were partly movable. The assumption that they also were caused by caterpillar hair was confirmed by the patient, who remembered that, while haying, his brother had thrown a dark-brown caterpillar against his right eye, which became inflamed immediately afterwards. In this case the nodules were enclosed in a thick capsule of connective tissue, probably from their long duration. The round cells were partly decaying; no giant-cells. Fragments of light yellow-brown hair, probably of *bombyx rubi*, the description and the time of its first appearance (September to October) being in favor of this supposition. The loupe revealed such a fine brown hair in the cornea, 1.5 *mm* long, parallel to its surface. There was no indication for the removal of the nodules in the iris, so that they could not be examined, but they undoubtedly were of the same nature as the subconjunctival. The eye healed under atropine, although three weeks after admission a slight injection with haziness of cornea recurred for a few days. $V = \frac{20}{200}$. The two first cases remained entirely without relapse.

Literature contains three similar cases.

The *first* was communicated by H. Pagenstecher at the fifteenth meeting of the German Ophth. Society at Heidelberg in 1883 (*Transactions*, 1883, p. 176). A caterpillar had entered the right eye of a child while playing. After rubbing the eye, burning and inflammation set in, which disappeared soon, but returned after about five months. Four weeks later Pagenstecher found the ocular conjunctiva sprinkled with miliary, tough, and movable nodules. Pupil oval; at the lower pupillary margin small gray nodules. He thought it was a tubercular eruption, and contemplated enucleation of the globe. But the microscopical examination of a conjunctival nodule revealed a hair in its centre. Its structure was the same as that of a tubercle. The same was found in the excised piece of the iris. Excision was followed by permanent recovery. The remaining nodules in conjunctiva and iris were gradually absorbed. The species of caterpillar could not be defined.

In the *second* case, observed by Weiss (*Arch. f. Aug.*, 1889, xx., p. 341), the nodules were wanting in the conjunctiva. The patient was a laborer, into whose left eye a caterpillar (*gastropacha pini*) had fallen, while he was engaged in collecting them, six months ago. The eye showed iritis with formation of nodules, numerous synechiæ (almost seclusion of pupil), and fine hairs, free in the iris and cornea. V = fingers near by. Antiphlogistics being without effect, four weeks later a piece of iris with nodules and hairs was excised. Three days after the operation an exacerbation occurred, but subsided after three weeks. $V = \frac{6}{36}$. The nodules had the structure of a tubercle with yellowish hairs, with irregular outlines in the centre. This caterpillar was abundant in the Palatinate in 1885 and 1886. The long brown hair showed microscopically a cellular integument, turned towards the point, *i. e.*, unfavorable for penetrating the skin; in the short, partly bluish hair of the back the opposite arrangement took place. The sections showed the first kind. Weiss calls attention to the investigations of Leydig and Karsten, who found that the lumina of the hair of *gastropacha rubi* and other saturnia species communicate with glands, so that the intense action of their hairs on the skin is a *chemical* one.

Wagenmann (*v. Graefe's Arch.*, 1890, xxxvi., 1, p. 126) published the third case. The previous history of a boy of nine years was that, in October, four months before the first examination, a long brown caterpillar was thrown into his eye, followed by a slight inflammation on the same day. V. diminished; 2-3 flat yellowish prominences on the nasal portion of ocular conjunctiva, caused by thickening of the subconjunctival tissue, with intense ciliary injection. On the limbus some small gray spots. Pupil irregular. Below the lower pupillary margin were two small-pointed prominences, with retraction of the tissue between. In the excised nodule tubercular elements with vascularized connective tissue at the margin were found, and in the centre a yellowish hollow hair with eroded outlines. The hair lay in the longitudinal axis of the nodule. Weiss thinks that it came from *gastropacha pini.* The iritis healed after one month without relapse, and apparently without impairment of sight. According to Weiss' and my observations the giant-cells were more numerous in the nodules with hair, and their nuclei central, not marginal, thus differing from tubercles.

Weiss mentions an endemic of external ophthalmia, observed at Eisleben, eleven years previously, caused by *cnethocampa pinivora*, frequent at that time. Such cases of conjunctivitis were often seen, most of which were caused by caterpillars. Baas (*Klin. Mon.*, 1888, p. 65) communicated two cases of an acute painful conjunctivitis with photophobia, probably produced by *cnethocampa processionea.* They healed in one or two weeks.

Fortunately, the protracted affections with formation of nodules, described above, are rare. The *chief danger* rests in the *iritic complication.* The structures of the hair, chiefly the little hooks, enable it to penetrate so far into the membranes of the globe, especially if favored by rubbing the eye. If we remember how often indifferent foreign bodies, lodged in the iris, start inflammatory relapses, it will be readily conceived that the hair, charged with cauterizing substances, and apt to change its position, may bring about circumscribed accumulations of round cells and produce giant-cells, and further on, violent and frequent reactions in the iris and cilary body, as described. In all cases the changes were found in the lower portion of the eyeball, the one mostly exposed to injuries while in the palpebral fissure, when the eye instinctively rolls upwards.

In order to decide the question by *experiment*, whether the hairs of bombyx rubi can penetrate the cornea and produce such inflammations, I pressed two such caterpillars on the eyeball of two rabbits. The result was, that numerous fragments of hairs could be detected in the different layers of the cornea. On the same day a dense haziness of the cornea set in, turning into a diffuse parenchymatous cloudiness within a few days, with formation of large and small vesicles and profuse secretion. The infiltration healed after a few months, leaving an extensive macula. No nodules in iris or conjunctiva, the hair probably not penetrating the cornea or sclera as far as to reach the iris. The cornea of one animal, which died after three months, showed under the microscope flat and diffuse infiltrations, and numerous pieces of caterpillar hair in its different layers, even in Descemet's membrane, thus proving that the pointed hairs are able to pierce the cornea and eventually invade the iris.

The diagnosis will not be difficult, if conjunctival nodules or free hairs are present, as such multiple tough nodules, persisting very long without decay, do not occur in general affections, nor in connection with other foreign bodies. In such cases, however, in which the iris alone shows nodules, the diagnosis is only possible after excision of that piece of iris, bearing the nodules, as their aspect and situation have nothing characteristic.

The *rare occurrence* of the disease may be explained by the fact that the invasion of the eye by a caterpillar is rare, and that even then it requires some force (throwing, rubbing, etc.) to drive the hairs into the sclera or iris through the cornea. On the other hand, we may suppose that this affection is not as rare in other regions, where *bombyx pini* and *cnethocampa processionea* are frequent, but that it may not be recognized. This may happen very easily on account of the mostly insufficient previous history, and because the characteristic subconjunctival nodules, which, even when persisting several years have no tendency to ulcerate, may be overlooked, especially after long standing. Besides, the nodules in conjunctiva and iris might be mistaken for tubercles with giant and epithelioid cells, of course without bacilli, if not all microscopical sections are carefully scrutinized. Only in a very small percentage of these, especially when cut obliquely, fragments of hairs are found, as they may fall out easily. Perhaps Leber and Haensell's "benign iris-tuberculosis" (*Klin. Mon. f. Aug.*, 29; supplement *Transactions* Germ. Ophth. Soc. at Heidelberg, p. 44) is the same affection.

The *prognosis* must be guarded, on account of the complicating iridocyclitis, which may lead to occlusion and seclusion of the pupil and further destructions.

Although *iridectomy* in the third case was without effect, and the three others healed in ¾ to 2 years with atropine, mercurial ointment, and blood-letting, besides these, iridectomy in the earliest stages is mostly to be recommended, when nodules are present in the iris, provided that they can be removed with the piece of iris. In Pagenstecher's and in Weiss' case the operation was followed by lasting recovery. The treatment may be shortened by excision of the subconjunctival nodules, which chiefly create the inflammatory symptoms and pain.

ON THE PATHOLOGY AND PATHOGENESIS OF RETINITIS PROLIFERANS (MANZ).[1]

BY DR. M. BANHOLZER.

Translated by Dr. WARD A. HOLDEN.

(*With Plate V. of vol. xxv., Germ. Edit.*)

B. M., a woman of thirty-nine, was received into the clinic October 3, 1890, with the following history:

Six days previously the patient had struck against the tongue of a wagon in the dark, injuring her left eye. There was severe pain for two days and the sight was lost. *St. pr.* Left eye shows chemosis and ecchymoses of the conjunctiva below; a conjunctival rupture on the nasal side; cornea transversely elliptical, folded, opaque in its inferior half. The anterior chamber containing blood. Interior of the eye dark; —T1. Perception and projection of light good.

Ten days later the blood in the anterior chamber had absorbed and an extensive iridodialysis was found on the nasal side. No red reflex from fundus. The eye gradually cleared up, and a pigmented scleral rupture could be clearly seen. Many flocculent masses in the vitreous.

February 3, 1891, four months after the injury, the eye became very painful, for which no cause could be found. The eye is free from irritation, and not sensitive to pressure. The scar is somewhat ectatic. The fundus is indistinctly seen. About the disc there is a light ring of connective tissue. No detachment of the retina can be discovered. The pain continued. Tn. Patient counts fingers.

May 25*th*, the pain becoming unbearable the eye was enucleated.

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[1] From the University Eye Clinic in Zurich.

At that time the eye was free from irritation and showed a scleral scar 1 *cm* long at the nasal margin of the cornea and concentric with it, and a coloboma of the iris on the nasal side, the pupil and coloboma being filled by a transparent membrane with opaque stripes and points. The vitreous contains opacities. The margins of the disc are blurred (Fig. 1). The disc is surrounded by a light ring, from which two slightly diverging white strands pass downward nearly to the equator of the eye. The retinal vessels run beneath these light projecting bands, except just beneath the disc, where one large vessel bends in a sharp curve over the band. No new-formed vessels are seen. The finer details of the fundus are masked by the opacities in the vitreous.

The enucleated ball was placed first in a saturated bichloride solution and then in alcohol. After hardening for three weeks it was divided by a horizontal section (Fig. 2).

The pupil and the coloboma are separated from the anterior chamber by a membrane arising from the ciliary body on the temporal side and ending in the scleral scar on the nasal side. The lens is wanting. Behind the iris and the pupillary membrane there is a fairly clear layer of vitreous about 5 *mm* thick. Continuous with this posteriorly is a yellowish-white opaque mass, which in its posterior portion is torn and folded, and is connected by a few fine fibres with the bands in the retina. The retina, with the exception of a small portion of the pars ciliaris rests in position on the choroid.

The disc is surrounded by wall-like elevations, 1.5 *mm* high on the temporal side, and 1 *mm* high on the nasal, having a smooth surface and a white color, passing gradually over into the retina laterally.

Beneath the disc is a nodule over which runs a retinal vessel, as was seen with the ophthalmoscope. From this nodule a white band 1 *mm* thick runs inferiorly. At its lower end this band spreads out like a fan, and thick striæ from its lateral margins are inserted into the retina. From the temporal side of the disc, a white band 0.5 *mm* in thickness passes downward and outward. Laterally it is accompanied by a flat white elevation. Inferiorly it broadens out and ends with fine fibres in the retina. Between the lower portion of this band and the elevation, a delicate membrane stretches through the vitreous. The elevation on the nasal side is irregular and furrowed.

The portion of the elevated wall above the disc passes over gradually into the level of the retina, and only a single band can be followed to the equator.

The retina in nearly its entire extent shows a light gray color from the hardening process. In the inner lower segment there is a dark patch, 4 *mm* in diameter, somewhat excavated, and sharply limited from the remainder of the retina.

The light tracts seen with the ophthalmoscope correspond to the apex of the higher elevated portions, while the flatter elevations were not seen with the ophthalmoscope on account of the cloudiness of the vitreous. While the macroscopic appearance indicated a retinitis proliferans, the ophthalmoscopic picture suggested Nagel's retinitis striata. The microscopic examination was of particular interest, since the former affection had been examined in but one case, and then at a late stage, while no case of the latter had been examined.

From the projecting portions of the retina numerous lamellæ run out into the cyclitic membrane, indicating traction from the side of the vitreous.

Between the limitans interna and the layer of ganglion cells are a quantity of new cells, particularly near the vessels.

The bulk of the retina shows no very marked pathological changes. In the elevated portions the particular change is an excessive proliferation of the inner portion of the supporting fibres, and a splitting up of their inner ends. Where the limitans interna is preserved, there is a wide interspace between it and the inner reticular layer through which the nerve-fibres run. In other portions there are dense connective-tissue tracts running longitudinally. These tracts are composed in part of elongated supporting fibres which have lost their radiar direction, and in part of connective-tissue fibres.

Nearer the apex of the elevations this layer becomes broader and looser, and is evidently the product of excessive connective-tissue hyperplasia and hypertrophy. In some places there is a limitans interna, in others the fibres end toward the vitreous in a network.

Near the disc the retina is thrown into several sharp, narrow folds.

The cause of the affection was the severe trauma with vitreous and retinal hemorrhages. Six months after the injury the ophthalmoscope showed a light, prominent ring about the disc, with a number of elevated processes running from it.

The changes were due, as the microscope showed, first, to a growth on the inner surface of the retina, consisting of proliferated supporting fibres and new-formed connective tissue; second, to a tissue resting on the limitans interna; and, third, to sharp, narrow folds in the retina itself.

The tissue lying on the inner surface of the limitans interna undoubtedly developed from a vitreous hemorrhage near the retina. The folding of the retina and the broadening of some of the layers may be considered to be due to traction from the shrinking tissue.

The question whether we have here a case of retinitis proliferans (Manz), or of retinitis striata, must now be answered in favor of the former affection. The light striæ observed in the latter affection, according to previous observations, never attain the breadth of those seen in our case. In retinitis striata the striations lie constantly beneath the vessels, in the deep layers of the retina, and usually show pigmentation. Nagel has therefore designated the affection as chorio-retinitis.

In the present case, as well as in most of the cases of retinitis proliferans that have been described, the retinal vessels lay for the most part beneath the white masses and tracts. The deeper layers of the retina and the choroid showed very slight microscopic changes. The case, therefore, cannot be considered one of retinitis striata until the microscopic examination of a case of retinitis striata shall show changes similar to those found here.

The scanty literature of the subject begins with Manz[1], although before this Jaeger[2] had given a drawing and clinical history of a case in his atlas. After a long observation of three similar cases, Manz described them as exhibiting a distinct disease, which he called retinitis proliferans. He supposed the retina to be principally affected, and later anatomical examination has verified his views. Leber and Michel have also described the disease. The older cases were spoken of by Manz.[1] New cases have been reported by Strawbridge,[2] Schleich,[3] Pröbsting.[4]

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[1] *Graefe's Archiv*, vol. xxii., iii., 229.

[2] *Beiträge zur Path. des Auges*, 1st edit., plate lv.

The first anatomical examination was made by Manz in an eye which had been a long time under observation. The condition found, however, at first glance presented little similarity to the case described here. Manz's eye showed hypotony, anterior synechiæ, atrophy of the iris, cataract, and total detachment of the retina.

Our case showed none of these changes. Microscopically the two cases were similar, inasmuch as in both the new-formed tissue resting on the retina consisted of proliferated Müller's fibres and new-formed connective tissue and vessels.

The changes in the pigment epithelium that Manz found are wanting here, and the condition of the limitans interna in our case is different. Manz does not speak of a tissue deposited on the inner surface of the limitans.

Manz was in doubt as to the cause of the detachment of the retina. In my opinion this was caused by the traction of the shrinking new-formed tissue.

The drawing of a frontal section of the posterior segment of the eye in Manz's[5] paper seems to indicate such traction. The portion of the retina which supports the new-formed tissue in the vitreous is folded in a way unlike that seen in the other portions of the retina. In the former positions there are numerous sharp folds the direction of which shows them to be caused by traction from the side of the vitreous.

It may reasonably be assumed that in most cases of retinitis proliferans showing tracts and elevations, such secondary retinal folds are concealed beneath them. This explains the fact that larger retinal vessels run above such tracts.

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[1] Becker, *Bericht über die Wiener Augenklinik*, 1867, p. 106. Hirschberg, *Klin. Beobachtungen aus der Augenheilanstalt*, Wien, 1874, p. 64. Schnabel, *Knapp's Archiv.*, v., i., p. 124.

[2] *Trans. Amer. Ophth. Soc.*, vol. ii., p. 304.

[3] *Klin. Monatsbl. f. A.*, vol. xxviii., p. 63.

[4] *Ibid.*

[5] *Graefe's Archiv*, xxvi., ii., p. 55.

The drawings of Manz, Schleich, and Pröbsting show the retinal vessels in these circumstances convex forward as we are accustomed to see them in detachment.

Many capillaries were found extending out in the proliferated tissue, but I believe that many of the large vessels seen in their cases owe their visibility to the detachment of the retina, and are not new-formed vessels, as we find many vessels in the gray retina after embolism or detachment, that had not been previously visible.

Another question of importance is the rôle that the vitreous plays in these cases. Whether the retinal proliferation is primary and the involvement of the vitreous secondary, cannot be definitely decided. We find, however, parts with excessive proliferation of the supporting tissue without deposits on the side of the vitreous.

Whether the detachment of the limitans interna favors the proliferation of the supporting fibres is doubtful, since the proliferation is found where the limitans interna is normal.

The etiology of retinitis proliferans should now be considered. Manz in his first publication said: "Intraocular hemorrhage which occurred in the course of the disease in my patients, stands doubtless in intimate causal relation with the proliferation." We may say further that in most of the cases published there has been intraocular hemorrhage, either in the vitreous or in the retina, occurring once or repeatedly.

As regards clinical course and prognosis, I have nothing to add to the clinical experience of the authors cited.

The fairly good vision which is sometimes found even late in the disease, finds its explanation in the fact that the nervous elements, particularly the rods and cones, are relatively intact. A final phthisis is however not rare.

Although my studies do not throw light on all the questionable points in regard to this affection, the case nevertheless explains in some degree the development of a disease which has hitherto been studied only at an advanced stage. The case shows particularly that the histological changes are in quality similar to the changes found in other ocular affections; but that in extent and in localization the changes are so characteristic that we must consider them as constituting a distinct disease.

Since the microscopic examination shows a proliferation of the supporting tissue of the retina to be the fundamental change, the name retinitis proliferans is pathologically correct.

In conclusion I wish to express my thanks to Prof. Haab for kindly furnishing me the material, and for granting me the use of the laboratory of the University eye-clinic in making these investigations.

DESCRIPTION OF THE FIGURES.

Fig. 1. Ophthalmoscopic sketch—inverted image.

Fig. 2. Inferior half of the ball.

Fig. 3. Transverse section of the retinal cord which extended upward. Beside it, normal retina.

A CONTRIBUTION TO THE ETIOLOGY OF THE SO-CALLED RETINITIS PROLIFERANS.

By Dr. S. SCHULTZE, Frankfort-on-the-Main.

Translated by Dr. Ward A. Holden.

(*With two figures in the text.*)

THE rare affection which Manz (*Graefe's Arch.*, xxii., 3) has called retinitis proliferans is not yet fully understood in its etiology and pathology.

Many oculists see such cases, but as they are rarely kept long under observation, and as no case has been examined anatomically,[1] not many have been reported.

The two cases to be described here are of interest, since they were under observation for many years and therefore throw some light on the etiology and genesis of the affection.

The first case was seen in 1870 by Dr. Göpel, who has given me the following notes of the condition at that time.

"C. S. æt. twenty-nine, a previously healthy laborer, complained of poor vision three weeks after an attack of fever, probably intermittent. *St. pr.:* General weakness, with rapid pulse. Heart normal. L V $\frac{8}{200}$, R V $\frac{5}{200}$. L vitreous shows diffuse and floating opacities. The retina, particularly near the papilla, shows grayish-green masses of exudation arranged in stripes. R vitreous cloudy near the disc. Disc red and blurred. A diagnosis of optic neuritis, with deposition of exudation upon the retina, was made. Under treatment with mercury and iodide of potassium the vision improved somewhat.

In 1890 the same patient consulted me on account of a traumatic conjunctivitis. He had always been well with the exception of the one attack of fever. No history of syphilis ; thoracic and abdominal organs normal. Urine contains neither sugar, albumen, nor oxalic acid. L V $= \frac{1}{12}$, central scotoma; R V $= \frac{5}{6}$, limits of field normal, blind spot larger than normal. The

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[1] See preceding paper.—H. K.

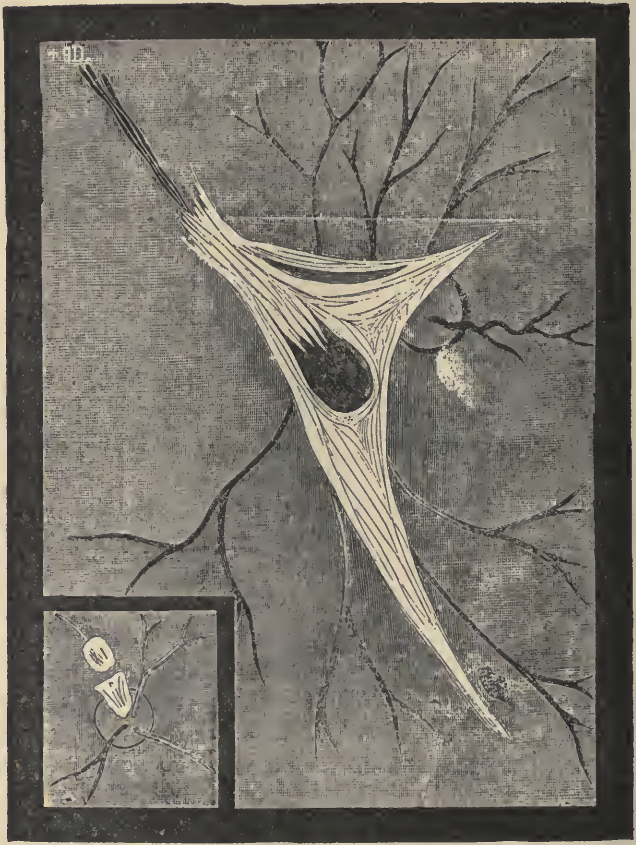

FIG. 1.

anterior segment of the eyes is normal. With the ophthalmoscope the right vitreous contains many floating black opacities. The nasal half of the disc only can be seen. It is yellowish-red in color, and from it runs a large tortuous vein. The temporal half of the disc is concealed by a membranous deposit, which spreads out over the neighboring retina in a triangular form

(Fig. 1). These strands have an elevation of 6 D. The superior one ends by dividing into fibres which run out into the normal retina. The others end in a sharp point.

This membranous deposit is composed of interlacing bundles of a varying height. No vessels are seen on the new formations and the retinal vessels run beneath them. At the termination of the superior strand, a number of small dark vessels run out free into the vitreous and end in loops which are seen with + 9 D. Near the ends of the inferior strand is a pigmented patch, but nowhere else in the fundus is there pathological pigmentation, and no hemorrhages are seen.

The left eye, with poorer vision, shows a few floating opacities of the vitreous. The disc is pale and the retinal arteries are small. There are two patches of deposit in the retina (Fig. 1, left-hand corner). A year later the condition was unchanged.

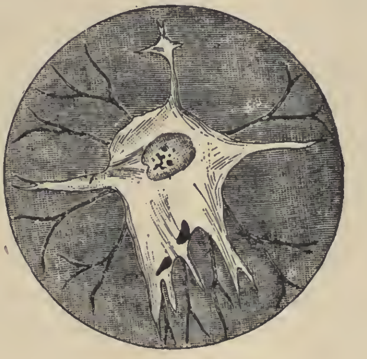

FIG. 2.

The second case was seen in May, 1889. A. B., æt. twenty-five, was healthy and had no organic disease. A year before vision became poor in the left eye and later in the right. Recently there has been a second sudden failure of sight. Ophthalmoscopically, the vitreous is diffusely cloudy, fundus not seen. R V = $\frac{1}{12}$, L V = $\frac{1}{12}$. The red corpuscles of the blood were normal in number, the white increased in number, and showing degenerated forms. The spleen and lymphatic glands were normal, however, and the patient had not a leukæmic appearance. In the following eighteen months there were several relapses, the patient being treated with iodide of potassium and iron.

Nov. 19, 1891 R V = $\frac{1}{100}$; L V = $\frac{6}{25}$. R vitreous shows floating opacities. The disc is concealed by a membrane (Fig. 2) which has an opening in its centre and sends a number of processes out into the retina. The retinal vessels run beneath the membrane. Near the outer margin of the membrane, there are two small apparently fresh hemorrhages. The surface of the membrane is fairly smooth, not being composed of bundles as in Case 1. The remainder of the retina is normal.

In the left eye the disc is red and the retinal veins are large and tortuous. In the periphery of the visible fundus there is a bluish-white deposit on the retina, about two disc-diameters in extent, with a striated surface without vessels. Two months later the ophthalmoscopic picture was unchanged.

The genesis of the first case is not clear, as retinal or vitreous hemorrhages were not observed, but from the history it is probable that hemorrhages had occurred.

The ophthalmoscopic picture corresponds to that described by other observers, except that new-formed vessels in the vitreous had not previously been found in this disease, although such vessels are seen in cases of hemorrhagic retinitis. The fact that the vision in the eye was $\frac{5}{6}$, speaks against a primary diffuse retinitis, as Manz assumes. Such an inflammation of the retina would hardly pass off leaving vision so good. The other eye with less change in the retina is blind, but the blindness is due to a post-neuritic atrophy of the optic nerve.

The second case was more closely followed. A man of twenty-five has repeated spontaneous hemorrhages into the vitreous over a period of two years. The membranous deposit on the retina is without doubt the result of the vitreous and retinal hemorrhages.

The literature of the subject is scanty. Jäger first described and pictured a typical case in his atlas, calling it a new formation in the vitreous. O. Becker and Hirschberg each described a case.

Manz (*Graefe's Arch.*, vol. xxii., 3, and vol. xxvii., 3) observed three identical cases and later examined one of them anatomically. This case, some years before the enucleation, showed the typical picture of retinitis proliferans, and the eye had finally become phthisical. In the shrunken ball with total detachment of the retina, Manz found a chronic retinitis with new formation of tissue on the inner surface of the retina, and therefore called the disease retinitis proliferans, since he regarded the inflammation of the retina as the primary change. But as the eye showed total detachment of the retina and other chronic inflammatory products, it is questionable in how far the changes found in the retina were related to the membranous deposit or to the inflammation leading to the phthisis. All of Manz's cases had vitreous hemorrhages.

Leber (*Graefe-Saemisch*) describes this affection in detail and reports several cases that he had observed. He thought the disease to be due probably to recurrent hemorrhages in the retina and vitreous, as these were always found if the case was kept under observation for a sufficient length of time. In one case the urine showed oxalates, and Leber thought that possibly oxaluria might lie at the bottom of some cases, as Mackenzie had also found it once. This supposition however has not been verified.

Alexander (*Deutsche med. Wochenschr.*, 1884, No. 40) in a healthy man, æt. twenty, with vitreous opacities, found a broad connective-tissue fold above the disc, projecting out from the retina. The retina also showed hemorrhages, and Alexander thought the vitreous opacities and the connective-tissue fold to be the result of hemorrhage.

Schleich (*Klin. Monatsbl. für Augenheilk.*) followed two cases for a considerable time and saw membranous deposits developed from previous retinal and vitreous hemorrhages. The correctness of Leber's supposition was thus proved.

Pröbsting (*Klin. Monatsbl. f. Augenheilk.*) reported a case that was complicated with retinitis albuminurica. It showed vitreous opacities, retinal hemorrhages, and the typical picture of retinitis proliferans. The proliferation of the connective-tissue elements of the retina, which he found after experimental hemorrhage into the vitreous, is of interest, and may be considered the analogue of the retinitis that Manz assumes. On the other hand, the connective-tissue proliferation may come on without inflammation, and remain localized, for which reason Leber hesitates to adopt the name " retinitis proliferans."

Martinet (*Deutsche med. Wochenschr.*, 1891, No. 9) described a case complicated with nephritis and diabetes.

In all these cases there were vitreous and retinal hemorrhages, or remains of them, and to these may be attributed the chief rôle in the development of the affection.

The ophthalmoscopic picture of retinitis proliferans corresponds almost exactly to that which we find at times after injury to the ball, where there are the glistening white elevated non-vascular deposits on the retina. In one of these eyes Waldeyer found a chronic chorio-retinitis with a plastic exudation on the inner surface of the retina, moderate fibrous degeneration of the retina, and atrophy of the choroid. The plastic exudation and the degenerated retina beneath it consisted of thick bundles of connective tissue running for the most part in a radiar direction but also interlacing to some extent. The new-formed deposit contained few cells and was not like ordinary young connective tissue. This tissue was in connection with the flocculent masses in the vitreous and was similar to them in structure.

I believe that here and in retinitis proliferans the new masses are not inflammatory and exudative, but rather deposits of unabsorbed blood fibrin. The deposits are in intimate connection with the retina and cause atrophy of the nervous elements of the retina and hypertrophy of the connective-tissue elements, and finally become themselves transformed into finely fibrous cicatricial tissue

Leber (*Graefe-Saemisch*) says: "After injury of the eye causing hemorrhages into the vitreous and into the coats, at times dense partially pigmented connective-tissue membranes remain, lying partly on the inner surface of the retina and partly in the retinal stroma and even in the choroid. . . . In shot wounds when the eye has not been injured directly, we may after a time find hemorrhages in the vitreous, after the resorption of which we find marked changes in the fundus, in the form of glistening white connective-tissue membranes with remains of blood and black pigment. The white patches lie in front of the retinal vessels and often project above the level of the retina. Probably there have been here blood coagula which were not absorbed, but have become transformed into connective tissue, while some of the coloring matter becomes dark pigment."

This description does not correspond to my idea of retinitis proliferans. Since in every case vitreous hemorrhages are found at some period, it is probable that we have to do here with an imperfect resorption of blood coagula which become adherent to the retina, and finally lead to a proliferation of the connective-tissue framework of the retina. The transformation of these coagulated masses into true connective tissue seems to me to be very questionable.

In conclusion I would repeat that the name retinitis proliferans is unsuitable for this affection, since an inflammation of the retina has never been observed as the primary disease, while retinal and vitreous hemorrhages are always found; the remains of these form finally the white deposits on the retina, which in my opinion are nothing more than unabsorbed masses of fibrin precipitated on the retina, that in the course of time assume the appearance of connective tissue and cause fibrous degeneration of the underlying retina. In those cases, however, in which the same ophthalmoscopic picture is found without hemorrhages or remains of such, it may well be a different disease and quite another pathological process, thus again proving that distinct diseases may eventually produce the same final results, and therefore often be falsely designated by the same name.

TREATMENT OF PTOSIS.

By Dr. A. MEYER, of Wuerzburg.

Translated by Dr. J. A. Spalding, Portland, Me.

(*With two illustrations in the text.*)

A GREAT many ophthalmic surgeons have asked me to publish a procedure for ptosis which I have personally applied to my own eye for the last five years. The point in question is not an operative method, but an apparatus to prevent the recurrence of ptosis. I have hesitated a great deal to do this, because I know how very difficult it is to represent the little apparatus exactly, and furthermore because it requires a person of no little intelligence, and after not a few experiments to understand its working in a comprehensive manner. More than that, it is very desirable that the patient himself should thoroughly understand the principle at stake, so that he can make plain to the physician and to the mechanic whatever mistakes there may exist in the apparatus, on account of which, as the apparatus must be arranged specifically for each case, more or less insecurity may result and the desired intention be thwarted. Owing, then, to these necessary conditions I am far from regarding my contrivance as being the best for every case. But if I can communicate to my fellow practitioners the experience which I have personally obtained by the contrivance of the apparatus, and accurately emphasize the various points upon which the greatest stress is to be laid, I believe that one or the other may obtain some advantage for patients afflicted with ptosis.

The *Centralblatt fuer Augenheilkunde* for 1890, p. 34, has an article by Goldzieher "On a Simple Procedure in cases of Ptosis and Senile Entropium," in which is described a spectacle frame for the treatment of ptosis.

"The apparatus consists of a horn spectacle-holder to the upper rim of which is attached a horn plate, the free margin of which is moderately curved. When the frame is placed on the nose, and pushed close to the eyes, the free margin of the plate will be pushed in under the orbital ridge, so that it not only elevates the lid, but prevents its falling again, acting thus as a sort of crutch."

Goldzieher insists that this arrangement must be fitted for each special case, according to the anatomical peculiarities of the patient's face and orbit. He then describes the ptosis operations devised by Pagenstecher and Panas, and emphasizes their cosmetic failures. With the latter assertion I can only agree, for, to say nothing of the cicatrices, the operation never restores to the diseased eye the fold in the upper lid beneath the orbital ridge, so that the eye loses part of its expression and the patient remains forever deformed to a considerable degree. These are the disadvantages of the operative procedure, to say nothing of the lack of success in restoring the function of the lid.

I must reject Goldzieher's apparatus, as unsuitable because, although it takes into consideration the elevation of the lid, it is impossible with the contrivance in position for the patient to close the eye; he cannot wink.

My apparatus, on the contrary, not only restores the expression to the eye by the preservation of the fold in the upper lid, but the patient can wink in a natural fashion even when the apparatus is *in situ*.

Helfreich has mentioned my apparatus in a note on Goldzieher's contrivance in Michel's *Jahresbericht* (1890, p. 400), but I doubt if any one can form a clear idea of the same from his brief description. For these reasons I will now attempt a description, as I have used it for some years.

Figures 1 and 2 appended at next page show the original apparatus and the modified form as now worn.

The apparatus is easily applied, and but slightly visible at a moderate distance.

Mine was a case of traumatic ptosis due to an extensive rupture of the upper lid by the blunt end of a mountain stick. The cicatrix, slightly visible at the external canthus, was caused by a plastic operation made five years ago to take the place of an extensive cicatrix due to the original injury.

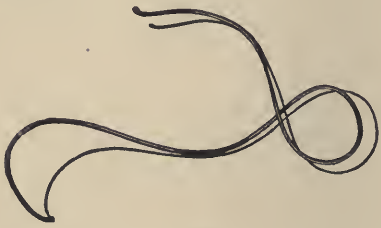

FIG. 1.

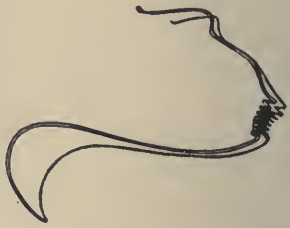

FIG. 2.

The attempt to excise a fold of the skin from the upper lid, or by the formation of subcutaneous suture-cords toward the forehead so as to elevate the lid, succeeded but partially and the cosmetic defect became more visible.

The operations enabled me to lift the lid so that about one third of the pupillary opening came into view, but it required considerable exertion, and the right eyebrow had to be elevated, which, in connection with the smooth transition of the upper lid into the forehead, caused considerable deformity.

But more than this, inasmuch as the injury was accompanied with fracture of the bone, the right eye suffered an impediment of mobility, associated with extremely disturbing diplopia, and I felt necessitated to construct an apparatus which should allow me free use of the injured eye, in order to oppose by uninterrupted exercise the existing diplopia.

The ordinary ptosis forceps, which, by raising a fold of skin, maintain the eye open most perfectly, nevertheless have the great disadvantage that even with the lightest instruments œdema of the lid ensues in a short time. Such an instrument I tried for a while, but was soon compelled to lay it aside.

My further investigations led me into the line of elevating the lid without interfering with its circulation. And starting out with the conviction that a single spring wire which, like the English monocle, could be pushed up under the orbit, and then supported upon the nose, must prove of use, I gradually constructed my present apparatus. I will now describe the origin of the definite form, because, from what I may have to say, one can most easily see how to avoid the difficulties which almost conquered me in my attempts.

The apparatus consisted first of the finest steel wire, and after several experiments I attained the form as exhibited in Fig. 1. The upper convex branch was pushed, with a fold of the skin of the upper lid, resembling that on the healthy side, up under the upper orbital margin. The lower branch was so formed as to lie close beneath the eyelashes of the lower lid, and so bent under the internal canthus that it found support against the nose. In order to get sufficient elasticity, a sort of loop corresponding to the external canthus was made as is shown in the engraving. The two free ends were made to terminate in small buttons.

On forming this accurately to the eye, according to the anatomical relations of the orbit and lids, the eye remained open, but it soon happened that the forces acting downward and outward upon the wire during the act of winking gradually tended to push it out at the external canthus. Additionally the twist in the wire at the outer side was too striking and observable. In order to obviate the latter, I tried to interpose between both branches of the apparatus an extremely thin and tightly coiled up spring, which being so difficult a task in steel or iron wire I had resort to all sorts of materials, nor did I fail to recall that steel was hard to mould to the parts.

I found after many experiments that 18 k. gold was the best material, for with the desired spring this could be easily interposed between the two branches, and the whole apparatus made in one piece.

In order to prevent the winking of the lids from thrusting out the wire, I attempted to gain a right angle of support between the nose and the upper orbital ridge by giving to the upper branch an angular bend as seen in Fig. 2. In this way I at once reduced the tendency of the wire to be pushed out of its situation. The free ends terminated in a very fine bend as seen in Fig. 2.

The thickness of the wire, barely one half *mm*, as well as the length of the interposed spring, and the elasticity and mechanical resistance of the lid elevator, must be fixed by experiments. In this way I succeeded in supporting the upper lid sufficiently, and yet in not preventing the orbicularis from overcoming the elasticity of the spring sufficiently to enable the eyelids to close perfectly during the act of winking.

Finally, the experiments resulted in the arrangement as figured in Fig. 2, but I would emphasize the fact that inasmuch as it must fit closely and smoothly to the parts for which it is adapted, it is plain, that all of the curvatures of the wire cannot lie in the same plane, so that particular attention must be paid to this peculiarity in each given case. With patience on the part of both patient and surgeon all of these difficulties can be overcome in time, and a useful apparatus perfected. Once well done it will last, as I have demonstrated by one that I have worn for some years without repair, and day after day without removal. I am generally obliged to look into a mirror in order to put the apparatus into place, but I can insert it by the touch. I can also state with confidence that I have never known it to irritate the eye in the least. The cosmetic success is plainly visible in the photographs.

In conclusion I hope that my suggestions may be of use to patients and ophthalmic surgeons in many a difficult case of ptosis.

OBSERVATIONS OF CONTRACTION OF THE VISUAL FIELD ACCORDING TO FOERSTER'S TYPE.

By Dr. O. KOENIG of Breslau.

Translated by Dr. J. A. Spalding, Portland, Me.

(*With twelve visual-field charts.*)

FOERSTER was the first to show that the most important symptom in anæsthesia of the retina, contraction of the visual field (C. V. F.), follows a peculiar type which, in brief, is characterized by the fact that the test object is seen farther toward the periphery when brought from the periphery to the centre, than when carried from the centre to the limits of the visual field (V. F.).

As it now happens that I have lately had an opportunity of observing that the same symptom occurs in traumatic neuroses, I would like to communicate my experience briefly, and to call renewed attention to a symptom that has up to this time met with but little if any attention from the profession.

For the sake of brevity I will, in the rest of this article, entitle this peculiar form of C. V. F. by the name of Foerster's type, or the displacement type, or the D. T. of C. V. F.

I will next remark that full accounts of this symptom can be found in the Transactions of the Heidelberg Congress for 1877, and in these ARCHIVES, vol. xii., p. 248, and that in order to establish the displacement type (D. T.) two measurements of the field (M. V. F.) with opposite movement of the test object are needed. If at the first M. V. F., we move the object invariably from the temporal to the nasal side, and note in each meridian the place where the object appears and disappears, then in the second M. V. F., the object must be moved from the nasal to the temporal side. Then we get two fields with intersecting borders, each of which is more extensive than the other in the direction from which the object was introduced into the V. F.

All of the fields except that shown in Fig. 8 were obtained by this method, and in order to understand them nothing more is necessary to say than that the arrows with continuous and interrupted lines indicate the direction in which the object was passed in the M. V. F., denoted by the same sort of contours. The plans were drawn on Foerster's schemata,[1] and a white quadrant 5 *mm* square employed as a test object.

I must emphasize the important fact that Foerster's observation furnishes us with a new and an *objective* symptom in pathology. The argument that this form of V. F. can be simulated seems to be futile, for only an expert could be sufficiently initiated into the displacement type as not to be detected. It is even doubtful if any amount of practice with the perimeter could enable any one to draw such a V. F. without errors. A malingerer to this extent would be a phenomenon. In a word, simulation seems to me to be so absolutely impossible that we need not dilate our article to discuss such an event in every-day practice.

I have remarked that but little attention has so far been paid to the extreme importance of Foerster's type. With the exception of Wilbrand's excellent paper already referred to, it is difficult to find any remark on the displacement type in any articles on neurasthenic asthenopia and allied disturbances. Amongst the few papers that have appeared upon this topic, I may refer to those by Thomson and Oppenheim,[2] Horstmann,[3] Schiele,[4] Pflueger,[5] and Voelker,[6] but even in these Foerster's method and the results obtained are merely mentioned and nothing more. Furthermore, the most recent hand-books on diseases of the eye either make no mention at all of the V. F. symptom, or they hint at it in so obscure a fashion that no one can get an exact idea of what they mean. Some remark that in anæsthesia of the retina the V. F. is subject to great variations, a remark which undoubtedly corresponds to the exact state of affairs. But in direct opposition to this we know that the variations in the V. F. entirely disappear when the test object is carried in the same direction time after time. More than that, we know that the extent of the field varies with various and repeated measurements. After all, however, in the D. T. we have an *objective* symptom which, without the patient's knowledge distinctly establishes an actual contraction of the V. F.

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[1] *Klin. Monatsbl. f. A.*, 1883, Supplement, p. 131.

[2] "Ueber das Vorkommen. u. d. Bedeut. d. sensor. Anaesthes. b. Erkrank. d. Central-Nervensystems." *Arch. f. Psych. u. Nervenkrankh.* Band xv., 1883.

[3] "Anaesthes. ret. als Theilserscheinung. allgem. Constitutions-Anomalien." *Zeitsch. f. klin. Med.*, Band xii., 1887; and *Deutsch. med. Wochensch.*, 1885. p. 335.

[4] "Co-Excitations in the Regions of Homonymous Visual Fields." These Archives, xvi., 417.

[5] Bericht ueber die Jahre 1884–1886. Bern, 1887.

[6] Beitrag. z. Casuistik d. Gesichtsfeldamblyopie. Inaug.-Dissert. Berlin, 1886.

Before appending the cases that I have seen, I will remark that the histories are often defective, because the patients merely came to the clinic, and some of them never reported a second time, or sufficiently often to enable careful notes to be made.

CASES OF INJURY OF ONE EYE, WITH CONTRACTION OF V. F. AND D. T. IN THE OTHER EYE.

CASE 1.—A boy of eighteen received a cut in the upper eyelid with puncture of the globe. When I first saw him in July, 1883, the upper lid of the right eye was united by a cicatrix to the globe, which was shrivelled in the posterior segment, cornea clear, pupil distorted, and behind the lens a gray immovable mass with a red reflex. On looking upward and inward the red reflex from the fundus is visible. Fingers counted downward and outward at three feet.

The same condition was discovered in October, only vision had still decreased. In the other eye, with vision of $\frac{20}{30}$, pronounced optic neuritis. Examination with the perimeter revealed to our great astonishment the well known type of C. V. F., as in anæsthesia of the retina (Fig. 1).

The same condition existed in January, 1884.

CASE 2.—A girl, æt. twenty-four, injured her right eye in March, 1883 with a large needle.

April 1.—Right eye, leucoma adherens, occlusion of the pupil, good perception of light. Iridectomy.

April 12th.—Eye free from injection, iris coloboma perfect, lens slightly opaque, fundus illuminated with difficulty. Fingers counted.

The patient did not return till October, and then only on account of diminution of the sight of the left eye within the last fortnight. The right eye was free from irritation, but the artificial pupil blocked with lymph, and the anterior chamber very shallow. T − 2. A candle was perceived as a spot of light at six feet.

Left eye. Typical sympathetic irido-choroiditis, with fine spots on Descemet's membrane; pupil slightly enlarged, round and rigid, but not dilating after atropin. $T = 1$, $v = \frac{20}{200}$, and Snellen 3. Mercurial inunctions.

V. F., examined November 7th, and found typically contracted as by Fig. 2.

The patient was discharged in three weeks; $\frac{20}{40}$; pupil adherent and occluded, but the papilla visible. The V. F. is shown in Fig. 3.

January, 1884.—The patient remained about as before, but owing to severe neuralgic pains about the right forehead and temple the right eye was enucleated. Previous to the operation the patient suffered from psychical hallucinations, saw mice and other creatures. These phenomena promptly disappeared after the removal of the eye. The V. F. remained about as before, somewhat less contracted than in Fig. 3.[1]

Case 3.—A boy, æt. fourteen, was hit in the left eye with a file. Long perpendicular cicatrix at the outer corneal margin, with incarceration of the iris and ciliary body. Atrophy of the globe. Two weeks later, November 5th, discharged with a shrunken globe, sensitive to the touch in the ciliary region, vision nil. Right eye, high degree of Hm, with amblyopia. V. F. not tested.

Three months later, the same sensitiveness in the scleral region. Right eye, vision $\frac{20}{200}$; V. F. typically contracted. Fig. 4. Enucleation of left eye.

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[1] I would remark that, owing to an oversight, the lines of the schemata which represent a normal V. F. have been drawn about as heavily as those of the two pathological fields, so that the distinctness of these figures where the two limits intersect has suffered. But any one can determine from Fig. 1, the limits belonging to the normal V. F.

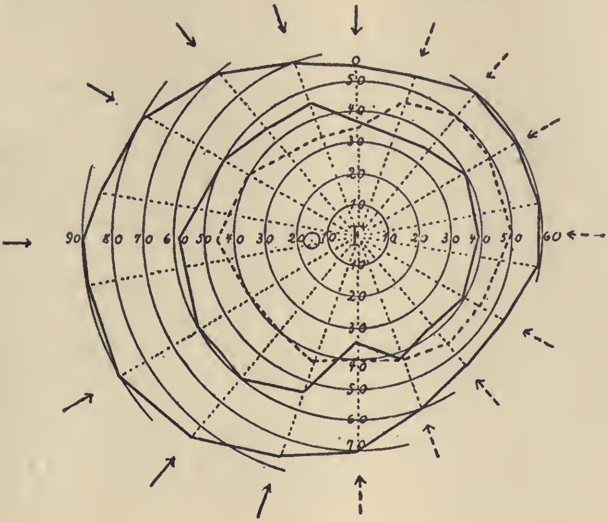
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FIG. 1.

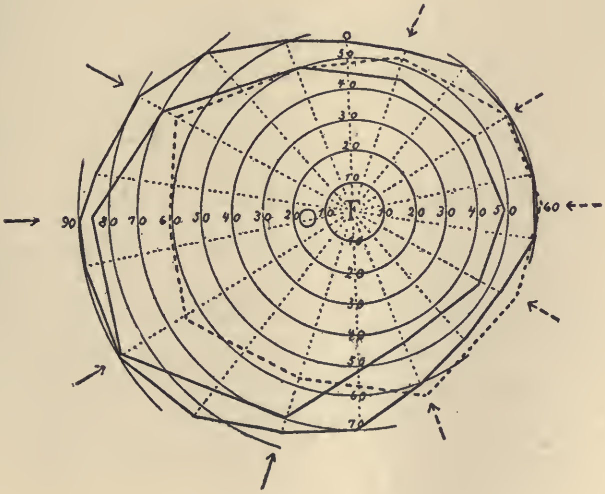
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FIG. 2.

January 4, 1884.—V. F. normal, no matter in which direction the test object is moved in the perimetrical examination. Vision $\frac{20}{80}$.

Case 4.—A boy, æt. eleven, injured his left eye with a bit of percussion cap, July 4, 1884.

July 9th.—Injury at inferior margin of cornea, considerable injection. Cornea and lens intact. Vitreous filled with a bloody exudate. Foreign body not visible. T−2; fingers, indistinctly close to the eye.

July 31st.—Fundus visible, exudate contracting, and close behind the lens a shiny particle can be seen, which in a few days proves to be the edge of the gun-cap. Fingers; T normal. Right eye, vision perfect, but the visual field contracted as in Fig. 4. The foreign body was extracted by scleral incision August 6th, but, though the incision healed by first intention, the sight remained destroyed. V. F. in the right eye remained, at the last visit in August, typically contracted.

Case 5.—Paul R., aged eight, was cut with a knife, five weeks before, in the ciliary region of the right eye. He was treated at first in another clinique, where finally enucleation was proposed. By the end of September, 1884, the right eye is somewhat atrophied, with a cicatrix at the outer margin of the cornea, with a small granulation attached. Pupil irregular, and vitreous hazy. No notes of the condition of the left eye are available. The injection of the right eye was reduced by the use of salicylate of sodium, and for that reason enucleation was postponed, as there were no subjective sensations on the part of the left eye.

The first examination of V. F. of the left eye on October 5th showed a typical case as in Fig. 5, November 7th, the sight of this eye fell a trifle below normal, but on the 8th it was once more normal, and the papillitis had disappeared.

It is not a new thing to see C. V. F. in the second eye after an injury to its mate. Mooren seems to be the first to have observed this symptom.[1] The case that he cites from v. Graefe[2] really does not belong in this category, as Brecht insists in presenting a similar case of his own.[3] Additional cases are to be found in Reich[4], in one of which, after total

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[1] *Symp. Gesichtsstörungen*, 1869, and *Ophthal. Mittheil.*, 1873.

[2] *v. Graefe's Archiv*, 1857, Band iii., 2, p. 442.

[3] *v. Graefe's Archiv*, Band xx., 1, p. 97.

[4] *Klin. Monatshl. f. A.*, 1889, Band xvii., p. 106.

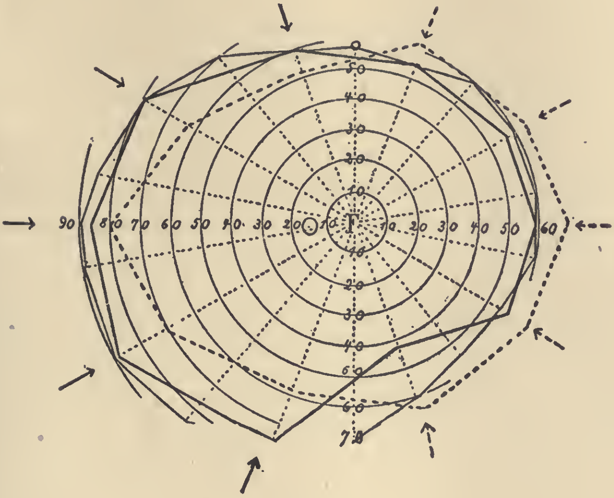
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FIG. 3.

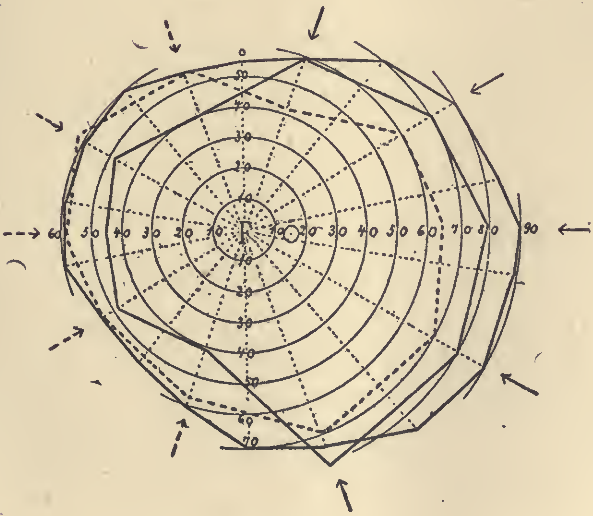
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FIG. 4.

destruction of an eye by gunshot wound, contraction of V. F., which the author regarded as sympathetic, was seen in the sound eye. I would emphasize, that in all of our cases in which any C. V. F. was observed, it invariably assumed the D. T.

All of the authors that I have named considered their contraction of the field as sympathetic, an idea that I cannot accept without some reserve so far as my cases are concerned. The main argument against sympathy is the presence of the displacement type, although the diagnostic significance of the same has not as yet been precisely defined, owing to the scarcity of clinical material. Still, it is just now receiving some support, owing to the fact that it has been only observed in anæsthesia of the retina or neurasthenic asthenopia; and in a disease that is very nearly related to the latter, viz., traumatic neurosis. Therefore, so long as we have no proof that it ever appears under any other circumstances, its simple presence argues in favor of a neurasthenic asthenopia rather than in favor of a sympathetic neurosis. I might also hint that most of the patients were young and one of them an hysterical girl, and then suggest that neurasthenic asthenopia is much oftener seen in children than in persons of adult age. And so far as sympathy is concerned, let us not forget that everything that is seen in the second eye after an injury to the first is without rhyme or reason invariably referred to sympathetic irritation. Therefore, so long as we cannot plainly prove the presence of sympathy, we shall be inclined to believe that the contraction of the V. F. is decided evidence of a neurasthenia of some sort.

Having noted that Herschel[1] had observed C. V. F. in

PARESIS OF ACCOMMODATION AFTER DIPHTHERITIS,

which disappears when the accommodation is restored, we turned our attention to similar cases, and at once discovered a normal V. F. I would remark that Herschel only found contraction in five out of thirteen cases. A careful and regular watch for such patients later revealed to us five typical

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[1] *Berlin. klin. Wochenschr.*, 1873, No. 30.

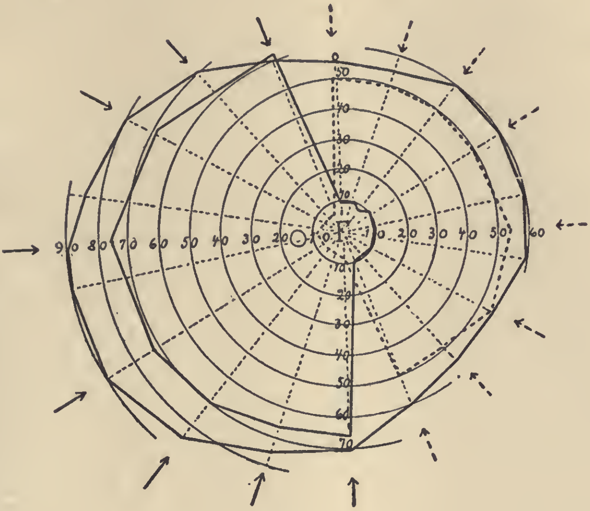
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FIG. 5.

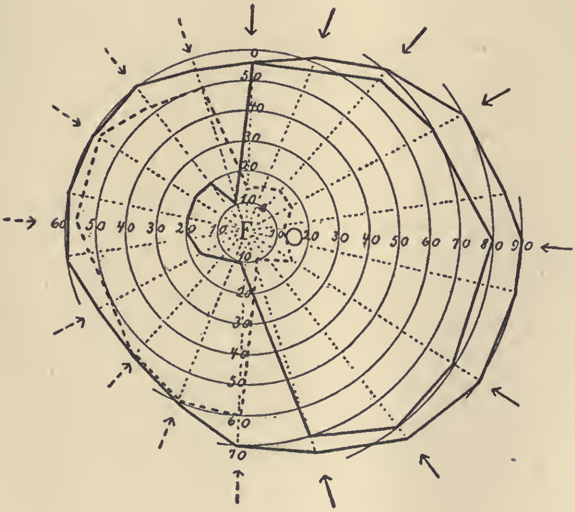
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FIG. 6.

cases of C. V. F., with Foerster's type, concerning which, by the way, Herschel says nothing at all.

Case 6.—Hedwig, æt. thirteen, had diphtheritis five weeks before, and had suffered for three weeks with paralysis of the velum, and still more lately has complained of disturbance of vision. Vision normal for distance with +24 and +17 for near. *C. V. F. in marked degree with the D. T.* (Figs. 5 and 6).

It is well to observe that whilst the contraction for the object brought from the periphery to the centre amounts to barely 20°, it amounts to 50° and even as much as 80° when the object is carried from the centre to the periphery. In other words, the perception of the object ceases when it has passed but a few degrees beyond the point of fixation. The paresis of accommodation rapidly disappeared under the use of appropriate lenses, and the V. F. increased in extent, but even after the total disappearance of the paresis of accommodation there was slight contraction for the object passed centrifugally.

I wish to call especial attention to the *approximation of the far point* in this case, for it was *repeatedly* observed, and corresponds, as I wish to recall to memory, to similar observations in anæsthesia of the retina.

Case 7.—Paula, aged eight, complained about Christmas, 1884, of weakness of the sight after diphtheritis. I discovered the same symptom concerning the far point as before, and similarly, excessive contraction of both V. F., with well marked displacement type. The schemata have been mislaid.

Case 8.—A boy, æt. twelve, had suffered from diphtheritis a few weeks before. July, 1885, all the symptoms of paresis of accommodation and velum; V. F. moderately contracted, but nearly normal for the object centripetally led. The difference between the two M. V. F., in the individual meridians, amounts to between 5° and 10°. In August the difference between the nasal halves of the V. F. had almost disappeared, but those in the temporal amounted to 6° to 16°. We often discover that this difference in the nasal half of V. F. is on the average less than in the temporal, so that the difference first disappears in the nasal half.

Case 9.—Marie, aged nine, accommodative paralysis after diphtheritis, with normal optic papillæ. Medium C. V. F., with well marked type. The figures in both eyes greatly resemble Fig. 7 of the following patient.

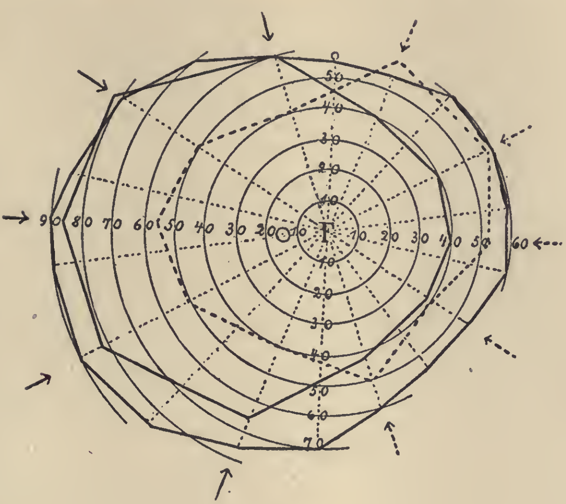
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FIG. 7.

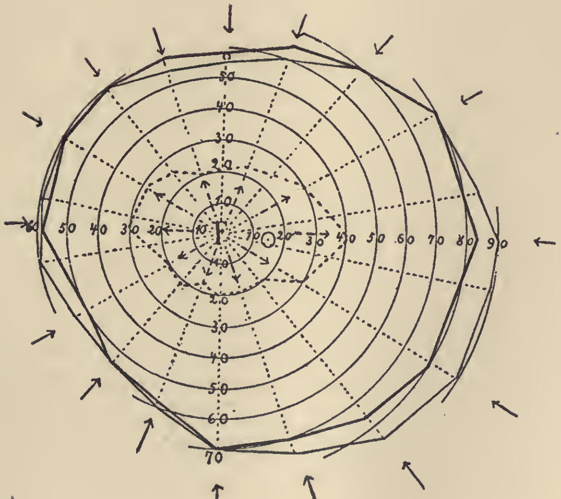
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FIG. 8.

Case 10.—Emily, æt eight, suffered from slight swelling of the cervical glands five weeks since. Lately she has developed loss of accommodation, is easily wearied, eats but little, and talks a great deal in her sleep. Every three weeks she complains of spasm in the head, with violent pain. February, 1886, hypermetropia, normal sight, with proper lenses, accommodative paralysis, and vacillation of the far point. V. F. extremely contracted, and typically. (Figs. 7 and 8.)

In the latter figure, the symptom of D. T. was fixed by the test object being first carried from the periphery to the centre, in the first measurement; and in the second, from the centre outward.

The patient was unable to read without hesitation for a long time, despite the use of proper lenses. Previously she had been able to read without any difficulty.

The C. V. F. continued without much, if any, alteration along into March, but in April it began to decrease, and by the end of the month it was nearly normal. The capacity for reading also began to increase, and at the end of the month vision was nearly perfect, and the eyes were able to bear any amount of light and to read without difficulty.

In meditating upon these cases, I come to a conclusion diametrically opposite to that reached by Herschell, who wants to separate them distinctly from genuine hyperæsthesia of the retina, "that neurosis of the retina first described by v. Graefe, and later studied more in detail by Steffan and Foerster," and regards the C. V. F. as due to the direct action of the diphtheritic poison upon the retina, as we assume it to act upon the nerves of the accommodation. On the contrary, I regard these cases as actual cases of anæsthesia of the retina, and I offer positive facts in support of my assertion.

Thus in Case 10 we had in addition to the paresis of accommodation the rapid weariness, photophobia, and incapacity of utilizing the retinal images of fine objects. Even when we used the strongest possible convex lens, the patient could only read with difficulty. The observation, that even when the paresis of accommodation had disappeared, the hypermetropia was no longer manifest, argues in the same line of thought. Then, in Case 6, though photophobia was absent, we saw the approximation of the far point, a symptom so frequent in true anæsthesia of the retina that I must acknowledge to it conclusive force. In the three remaining cases we have nothing left but Foerster's V. F. type to support the diagnosis of anæsthesia of the retina, and even this has not yet won universal acceptation as a symptom. Therefore we shall be obliged to take it for granted that the children suffered from a neurasthenic condition, which possibly was previously present, but only became a contingent symptom when the diphtheritis excited it into active agency. Hence the diphtheritic virus would only indirectly cause the C. V. F., in the same sense as other severe constitutional disorders produce anæsthesia of the retina, and thereby are enabled to excite the contraction of the field.

In concluding this section, I would remark that all five of these patients *suffered from paralysis of the velum.*

The following is a case *of neurasthenic asthenopia*, which as such would not be of any particular interest, but is important in that the morbid picture was confused by the presence of a *paresis of the* SYMPATHETIC, a complication which is in this case more accidental than in the preceding.

CASE 2.—Margaret, æt. twenty, May, 1884, complains of flickering before the eyes, lachrymation, and incapacity for reading or any close work for the past year. Photophobia, sympathetic paresis, in that the *left* palpebral fissure and pupil are perceptibly narrower than the right. The left lobe of the thyroid gland is enlarged. The patient has observed greater warmness and fulness on the left side of the face. *Perspiration is observed on the right side only.* She also blushes solely or at least much more noticeably on the right cheek. The patient is pallid, and invariably has a pulse of over a hundred at the clinique. At home it is slower.

The eyes are normal in every respect, with the exception that the V. F. in both is typically contracted as in Fig. 7.

Treatment, potass. iodidi. After using 40 grm. iodism, with conjunctival catarrh, which proved obstinate. The iodide was discontinued after using a little while longer.

By July the swelling of the thyroid and the diminution in the size of the palpebral opening had decreased.

During this period the V. F. was repeatedly tested in each eye, but always with the same result. The contraction remained typical. Curiously enough, the patient asserted that the weak zinc lotion prescribed for the iodidic conjunctivitis caused intense pain and lachrymation in the *left* eye, while in the right there was no irritation at all. This sensitiveness of the left eye gradually disappeared.

We saw the patient for the last time in September, when the eyes were normal in function, but the C. V. F. still persisted in both eyes, though to a less amount than in July.

TRAUMATIC ANÆSTHESIA OF THE RETINA

has long been recognized, but the number of cases is much less than those of the spontaneous sort. It is, however, unfortunate that all, or most of the cases of traumatic nature were reported years ago, and that the M. V. F. are not reliable. The following case came under my observation, *and revealed the well known Foerster's type.*

Case 12.—Carl, æt. forty-five, injured his right eye in the autumn of 1871, so that it had to be enucleated. The left eye began to fail about two years ago, so that a lens was necessary for near work. June, 1885, a spark struck the left eye, and was at once treated in the workshop with ice-cold applications. As the sight, however, steadily decreased, the patient was brought to the hospital, where he was treated with eye lotions and internal medications. There is no note of any severe injury of the eye, and the patient was discharged in a week or so, though the sight remained very much diminished. He reported from time to time, but up to May, 1886, when he came for an official report concerning his ability to perform any manual labor, there had been absolutely no improvement in the sight, if really what he had amounted to useful vision at all.

May 8, 1886.—Anophthalmus right side. Left eye *without a trace of any injury.* Cornea and aqueous transparent, iris and pupil normal. The lens shows a few faint opacities, but the fundus is perfectly visible through them. No abnormity in the fundus of the eye. Refraction em., T normal.

The vision, which one would hope ought to amount to at least ½ and the capacity to read fine type, actually amounts to the

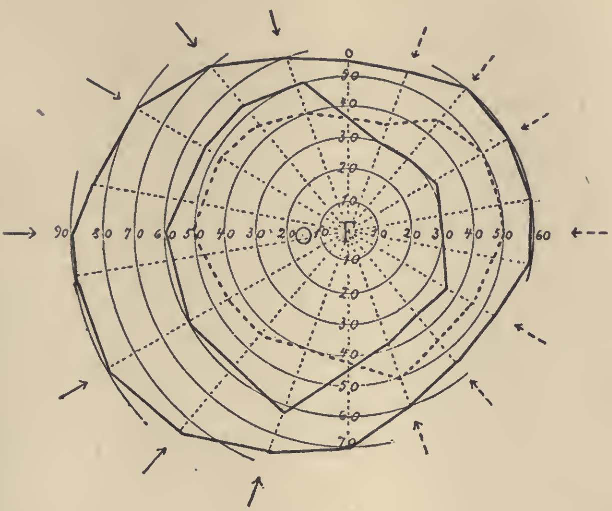

FIG. 9.

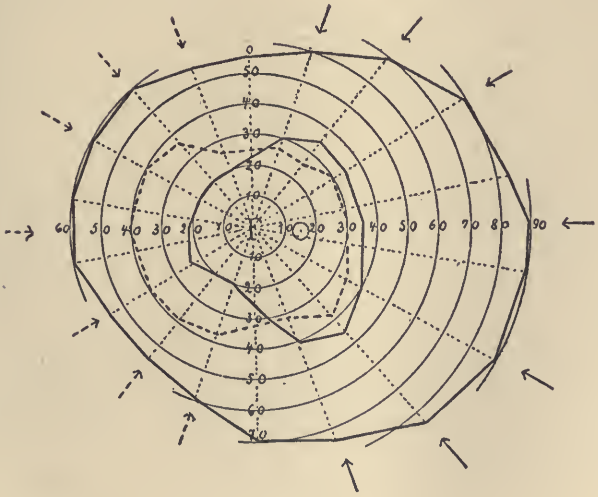

FIG. 10.

counting of fingers at 5 feet, and deciphering of Sn. XVI. with + 5 at 2 inches.

The perimeter reveals no scotoma, but typical C. V. F.

The V. F. was repeatedly measured for verification, but always found typically contracted. The patient feels perfectly well, can walk by the day without fatigue, but cannot see to do his former work as a blacksmith. The eyes are free from every subjective sensation, except the amblyopia.

I do not see how I err in calling this *a case of traumatic anæsthesia of the retina*, and I am sure that it is difficult to call it anything else, when we reflect upon the normal condition of the fundus after the disease had lasted a whole year. Still I do not affirm that the slight injury excited the disease, but that *a neurasthenic asthenopia must have existed some time before*, as seems established by the patient using glasses at an early age. Possibly this is the case in all of these patients, so far as reported, for generally the injury stands in disproportionate minuteness to the magnitude of the subsequent loss of sight. I would also like to suggest, that Cases 1 to 6 might be included under the heading of traumatic anæsthesia of the retina. This case (12) is of great value as establishing the importance of Foerster's type of V. F., *as a preventive against simulation*, for this man with no sign of injury in the eye, might easily have been regarded as a malingerer.

CASE 13.—This is merely the drawing of the V. F. of a cigar-maker who had been hit in the right eye with the fist of an opponent two days before.

Here the differences between the M. V. F. are on the average *smaller in the temporal halves of the V. F.* than in the nasal. Left eye normal.

The next three cases fall under the title *of supra-orbital neuralgia.*

CASE 14.—Marie, aged twenty, complains of pain on the left side in the region of the supra-orbital nerve. *Typical C. V. F. in both eyes.* The fields resemble Fig. 1. The left eyesight was somewhat more affected than that of the right.

CASE 15.—Henry, aged twenty-four, with typical infra- and supra-orbital neuralgia with well-pronounced C. V. F., in both eyes *and the displacement type.*

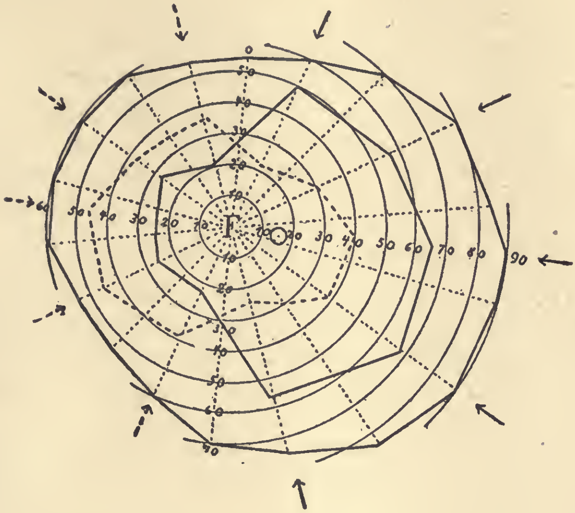

FIG. 11.

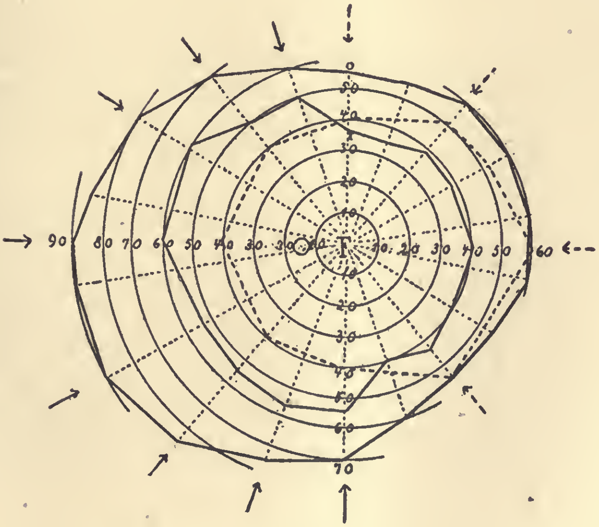

FIG. 12.

Case 16.—Anna, aged sixteen, complains for the past three weeks of pains in the forehead, first right then left, and so violent at times that they prevent her from working. Similar condition three years since. The headache does not depend on near work. Photophobia to artifical light. Patient rather timid at little things. Right supra-orbital nerve sensitive to pressure. Both eyes myopic. Both V. F. typically contracted and to a marked degree.

IDIOPATHIC HEMERALOPIA.

Case 17.—Hermann, aged thirteen, has been unable to find his way about at night for two months. Photometer, $\frac{17}{15}$. After four day's sojourn in a dark room, the hemeralopia disappeared. The right V. F. exhibited *typical contraction.* The left field was not perimetered.

Case 18.—Pauline, aged thirty-eight, defective vision of late by dusk and darkness. In bright light no defect complained of. Myopia. Media transparent. V. F. of right eye is shown in Fig. 11. That of left eye similar. Laxatives ; dark room.

After some weeks of treatment there was but slight improvement in the hemeralopia, but the V. F. remained the same.

The subjoined case of Glaucoma exhibited surprising results.

Case 19.—Carl, aged seventy-three, was suddenly attacked in January, 1885, with pain in the left side of the head, and redness and irritation of the left eye. On the following day the typical picture of glaucoma acutum had fully developed. The perimeter showed a condition as in Fig. 12.

The right eye was also tested in the horizontal meridians and exhibited a similar contraction.

Inasmuch as the patient could not arrange his affairs so as to have the operation performed at once, the attack was treated with eserine and salicylate of soda, with the result that in a few days vision and V. F. were nearly normal, and the displacement type had disappeared. March 1st the patient suffered from a second attack of glaucoma and on the next dry was iridectomized. At the last examination, a short time since, V. F. was normal in each eye.

Case 20.—A medical student addicted to morphine complains of flickering before the eyes and periodic obscuration of V. F., with attacks of vertigo and pressure on the forehead. The V. F. is normal for the test object carried toward the centre, but the difference between the two M. V. F. amounts in the left eye from 5° to 20°, and in the right eye to between 30° to 35°.

Finally I have lately heard of a patient with Foerster's type who suffered at one time from neurasthenia, and who ultimately developed and died from dementia paralytica.

So far as any opinions can be drawn from these observations, I have said what was necessary at the proper place, and therefore my conclusion to this paper may be brief. It was my aim to point at the frequency as well as at the importance of Foerster's type *as an objective symptom, which deserves to be tested both as to its absence and to its presence, as much as the contraction of the V. F. itself.*

Instead of carrying the test object directly across the entire field, which Schiele calls the diametrical method, he has suggested a variation in which the test object is always carried in a centripetal direction to the point of fixation, not simply to the limit of perception. Schiele calls this the *complete radial centripetal method*, and it has given me many very interesting results. Still in a *practical* point of view it falls behind Foerster's method, amongst other reasons *because the displacement type when present can be demonstrated in a few minutes.* For the two tests with diametrically opposite conduction of the test objects hardly need a pause between. The symptom in question can therefore be easily discovered in one's office hours, provided that the patient is intelligent enough to determine the limits of his V. F. upon the perimeter.

I have spoken plainly enough my own opinion concerning the diagnostic value of Foerster's type of C. V. F. in the previous pages, but further investigations will be necessary to tell us whether it is *actually pathognomonic for neurasthesia*, so that it can always be utilized in a differential and diagnostic point of view.

THE SUBJECT OF THE DESIGNATION OF THE PRINCIPAL MERIDIANS IN ASTIGMATISM,

AS BROUGHT BEFORE A MEETING OF THE SECTION ON OPHTHALMOLOGY OF THE PHILADELPHIA COLLEGE OF PHYSICIANS.

By Dr. G. C. HARLAN, Philadelphia.

I THINK it will be admitted that it is desirable that a formula for glasses, wherever written, may have a definite, precise, and uniform meaning in all parts of the world. Since the adoption of the metric system this is now the case where spherical lenses only are concerned, but is very far from being the case where cylinders are involved. A glance at some of the recent text-books will show at once the diverse and too often loose and random way in which the important matter of designating the direction of the axes in astigmatism is still generally treated. Landolt prefers to make the top of the vertical meridian his starting-point, and number right and left to 90° at the horizontal meridian, but gives no reason for his preference. Javal places zero at the left end of the horizontal meridian, and numbers to 180° at the right end; but estimates right and left with relation to the observer, and not, as we do, with relation to the patient, so that his zero corresponds with our 180°. Galezowski makes no reference to the subject, and Fuchs ignores all meridians but the vertical and horizontal. Schmidt-Rimpler adopts the same plan as Landolt does, and Schweigger does not advocate any system, but merely tells us to "direct the optician." Neither Juler, Berry, nor Swanzy gives any directions for designating the meridians; while Hartridge, more definite if not more scientific, advises the reader to indicate the axis "by drawing a line through a diagram furnished by the optician."

Swanzy, in an article urging the importance of uniformity in the designation of meridians (*Ophth. Rev.*, July, 1886, p. 208), states that there are at least five systems in use in the United Kingdom, and that Continental countries have no greater uniformity. He favors the system which, he says, has the advantage of being in general use in the United States, but states it incorrectly. He says: "0° is placed at the right-hand end of the horizontal meridian of each eye of the trial frame—the latter being viewed from the *front*—and 180° at the left-hand end; 90° coming at the lower end of the vertical meridian." The fact is that 90° comes at the upper end of the vertical meridian, so that our graduation proceeds in the opposite direction to that which he indicates.

An element of confusion is introduced into the identical method of notation by the question whether the terms right and left are understood, in the direct sense, in relation to the patient, or in reference to the observer facing the patient, and has been the cause of much misunderstanding. A commission appointed by the French Ophthalmological Congress in 1887 to consider this subject, composed of Javal, Martin, and Parent, objected to the plan of numbering each way from the top of the vertical meridian, which seems to have been the only symmetrical plan considered, chiefly because it involves the duplicating of numbers, and reported in favor of retaining the identical method then in general use. As to the direction in which the graduation should proceed, they recommended the system, borrowed from astronomers, according to which the numbering follows the course taken by the hands of a clock, and approved the plan that had been universally adopted by their American *confrères* for some years, viz., to place zero at the end of the horizontal meridian to the patient's left, and count on the upper semicircle to 180° at his right. That this plan has not been followed by at least one member of the commission, is shown by this autograph prescription of Javal, in which zero is placed at the patient's right. It would have been filled incorrectly by the Philadelphia optician to whom it was sent if it had not been accompanied by an explanatory diagram. It is, in fact, in accordance with the system in general, if not universal, use in France—commencing at the patient's right, and numbering on the upper semicircle to 180° at his left. The conclusion of the commission was opposed by Landolt, Meyer, and other members of the congress, who preferred the symmetrical method, and after a long discussion the question was postponed.

The following extract from a recent publication entitled *A Hand-Book of Spectacle Adjusting for the Use of Jewelers and Opticians* furnishes a contribution from the optician's standpoint: "It will be observed that the vertical meridian is always at ninety degrees, while the horizontal meridian may be either zero or one hundred and eighty degrees; and it should be further noted that these figures refer to the frame as it sits on the patient's face and is seen by the optician standing in front of it. This is sometimes a difficult matter to understand (where to commence and where to end counting), and I have introduced the diagram in the hope of making it plainer. My experience with opticians leads me to believe that many of them do not have clear and definite knowledge of this matter; and it sometimes proves itself a bugbear even to those otherwise well informed. I remember, a great many years ago, hearing one of the medical students attending the clinics at the Wills' Eye Hospital (the most noted hospital of its kind in Philadelphia) ask the surgeon in charge, who was an eminent oculist, where the numbering commenced of the degrees used to denote the position of the axis of cylindical lenses. The oculist replied, on the right; then corrected himself and said, on the left, and seemed to be confused; and was really unable to give a definite reply to the question until he had called for a trial frame and given the matter several moments' consideration. One would think an oculist of age and experience would have been able to answer this question without a moment's thought, and yet this little incident serves to show that this question may prove a source of confusion as well to the educated physician as to the less pretentious optician."

I think I have said enough to show the confusion in which this important matter has been allowed to remain and the entire absence of anything like a uniform system. As to the system now in use generally, but by no means universally, in this country I cannot find that it has anything special to recommend it on the ground either of scientific accuracy or practical convenience.

The first reference to this subject that I can find in Amercan literature is in the *Transactions of the Ophthalmological Society for 1868*, where Dr. Noyes precedes the record of a number of cases of astigmatism with the statement that: "The direction of the axis of the cylinder is always given according to Javal's notation—taking the upper half of a circle and counting the degrees from left to right from 0° to 180°." At the same meeting Dr. Green also reported some cases of astigmatism, and said: "The system which I have adopted for designating the angle of inclination of the meridian of greatest curviture is to call the vertical line zero, and to count off the number of degrees of inclination on the right hand up to 90° with the plus (+) sign, and upon the left hand with the minus (–) sign. By this plan the important and very interesting fact of the symmetry or asymmetry of the two eyes is distinctly shown." This is the only suggestion I can find, until nearly twenty years later, to designate the meridians with reference to the symmetry of the eyes, which is, after all, as Dr. Knapp has recently claimed, the only scientific basis.

Just when or how the present system of numbering from the patient's left to right, which has been in universal use in this country, originated I cannot make out. I remember that some years ago Dr. Knapp introduced the subject verbally at a meeting of the Ophthalmological Society and that there was a general understanding that this system should be used, but I cannot find any reference to it in the *Transactions*. The trial frames in the Nachet test sets may be considered responsible for it, but I do not know by whose order the first one was made. This plan, since it has become general throughout the country, has served our purposes fairly well, but we have been working with it now for a good many years and I believe that none of our foreign *confrères* have followed us. It would be a good thing if some plan could be adopted with advantages enough to recommend it to universal use. As Dr. Knapp has taken the initiative in this matter, I wrote the other day to ask him to let us have his views, and he has very kindly sent me the following paper:

"Our eyes are symmetrical to the median plane of the body, as are our hands, ears, feet, etc. The vertical meridian, or one near it, has in the great majority of cases the greatest refractive power. Its upper end is the natural starting-point of our calculations. If we designate it with 0°, or better with *v*, and its deflection towards the nose or temple with so and so many degrees of nasal or temporal deviation, down to the horizontal, *h*, or *90°*, we have a simple and unambiguous system of notation, the value of which remaining the same whether we look through the spectacles, or on them when the patient wears them.

"$+ 2.00^c\ 15^n$ means a + cyl. of 2 dioptries, the axis of which is inclined 15° toward the nose. Adding a spherical to it, the formula would read $1.00 + 2.00^c\ 15^n$, or shorter, $+ 1. + 2.^c\ 15^n$. If this is the same for both eyes, the formula is written once only and the word "both" added, $+ 1. + 2.^c\ 15^n$ both. If they differ, we have to write R. and L. for the right and left eye.

"R $+ 1. + 2.^c\ 15^n$; L $+ 1. + 2.^c\ 45^n$. If the deviation is on the temporal side, t instead of n is added to the number of degrees. This shows at a glance in what sense and to what degree the symmetry of the meridians is disturbed.

"Since I published this mode of designation of the meridians in the ARCH. OF OPHTHALMOLOGY, vol. xv., p. 207 (1886), I have used it in all cases, in private and hospital practice, and never a question as to its meaning has been addressed to me by an optician or anybody else. Other oculists in New York have adopted it, and opticians (Gall & Lembke, E. B. Meyrowitz, and others) furnish blanks on which, for greater accuracy, the directions of the axes of the cylinders may be marked.

"*The American mode of designation is incongruous*, for instance:

"O D + 1. + 2.ᶜ, axis 105°
O S + 1. + 2.ᶜ, axis 75°

means the same glass for both eyes, the axis of the cylinder turned 15° toward the temple. This system has had its day, and Javal and his friends have not been able to introduce it into France (see discussion "Sur la Notation de l'Astigmatisme," *Bulletins et Mém. de la Soc. Franç. d'Ophtal.*, 1887, p. 228). At the time when it was introduced the importance of the symmetry of the meridians was not recognized, if it was known at all.

"Two other modes of designation are worth considering:

"*A.—Count from the nasal end of the horizontal meridian up and around to the temporal end, from 0° to 180°.* The words nasal and temporal fall off, and the formulas are simple and unambiguous; 75°, for instance, would be a nasal deviation of 15° from the vertical meridian in each eye, and so on.

"*B.—Count from the upper end of the vertical meridian down the nose to its lower end, from 0° to 180°.* This is equally simple and clear, and shows the preservation or disturbance of symmetry.

"Both these systems have the disadvantage of expressing the slightest deviations from the original meridian by the greatest numerical differences. For instance, if in B the axis of the cylinder in the right eye is vertical, and in the left 5° temporal, it would read R 0°; L 175°. If in system A the axis of a concave cylinder is horizontal in the right eye, and its temporal end is raised only 5° in the left, it would read R 0°; L 175°.

"The mode of designation according to Javal as recommended by Schiötz in the same volume of the ARCH. OF OPHTHALMOLOGY in which I published my proposition (vol. xv., p. 201), is taken only from one method of examination, that of Javal-Schiötz's ophthalmometer. This instrument, though valuable, is cumbersome, and its results cannot be used for the prescription of spectacles without being verified or corrected with the trial case. It has, besides, the drawback of indicating only the positions of the principal meridians, not the axis of the cylinder to be prescribed. The optician must be specially instructed that for + cylinders the axis is as prescribed, but for — ones it is at right angles to the direction noted in the prescription.

"To be familiar with some objective method of examining the refractive state (upright or inverted image, retinoscopy, ophthalmometer) is indispensable, but we have, as a rule, to verify the results by the subjective examination, and the writing out of the prescriptions is, I think, best done in the customary order—first, the spherical glass; then, the cylinder; and, last, the axis, not reversing it as Javal does.

"The designation of the position of the meridians by starting from the upper end of the vertical meridian and noting the nasal and temporal deviations, conveys at once a clear image to the mind, requires no special instruction to the optician, and is in harmony with our usual mode of designating the position of the meridians in anomalies of motility where we say the (upper end of the) vertical meridian inclines toward the nose or toward the temple. Furthermore, it will assist us in finding the relative frequency of the degrees of oblique astigmatism.

"I propose to use the same method also for the annotations of the visual field, for F, as well as the position of the meridians, is symmetrical in its configuration in the two eyes, extending 60° nasally, 90° temporally, etc., in one eye as in the other. Here we would count from the upper end of the vertical meridian nasally (n) and temporally (t) down to 180°. The American method of designating the meridians of F, which I formerly recommended to preserve as being based on the physiological identity of corresponding retinal points, has no practical advantage over the designations into right and left halves. In this way, which I advocate in conformity with other oculists, for instance, Snellen, Landolt, Panas, etc., we gain a uniform mode of designation for the different branches of functional examination of the eye, astigmometry, motimetry, and campimetry."

I had a long talk with Dr. Knapp on this subject after the meeting of the Ophthalmological Society last summer, and while he convinced me, rather against my will, of the necessity of a change, he did not quite convert me to the change that he would bring us.

Perhaps the only important objection to the system that he prefers is the duplicating of numbers and the necessity of distinguishing them by some mark, such as "n" and "t," as he suggests, or by + and —, as has been suggested by Dr. Green and others. But this seems to me a very serious objection, as, in recording our cases, we desire brevity and simplicity above all things, when we can get them without the sacrifice of scientific accuracy. Even "O D" and "O S" seem sometimes a burden to overworked clinical recorders, and it is to be feared that, in the press of business, the "n's" and "t's" might sometimes get mixed or dropped, when the record would at once be without definite meaning.

The plan which I suggested and which still seems to me the most simple and, all things considered, the most favorable, is to place zero in each eye at the nasal end of the horizontal meridian, and count to 180° at the temporal end. The advantage of this plan is that whether we are designating the inclination of an axis in astigmatism, locating a position in the topography of the fundus by the ophthalmoscope, or indicating a limitation in the field of vision—the simple mention of a certain number of degrees instantly gives a definite and accurate mental picture, without stopping to consider whether the number is on the right hand or the left, or whether we are to estimate it with reference to our own eyes or the patient's.

To those of us who are inclined to be conservative and economical, it may be a point worth considering that this change would involve very little disturbance of vested interests. We would only have to change one side of our trial frames, and simply treat the left eye as we have been treating the right for so many years.

I would submit that in astigmometry, campimetry, and ophthalmoscopy this plan is not open to serious objections. The only objection that occurs to me is that it is not in accord with the language we use in designating the positions of the meridians in describing anomalies of motility.

The subject was referred to a committee composed of Drs. Risley, Harlan, and Thomson, who, at a subsequent meeting, submitted the following reports:

REPORT OF COMMITTEE ON THE DESIGNATION OF THE MERIDIANS IN ASTIGMATISM.

MR. PRESIDENT:

Your committee appointed to consider and report upon some uniform plan for the designation of the meridians in astigmatism have thought best to present their report in such shape as will leave it still open for discussion by the Section.

While the members of the committee are equally mindful of the necessity for the adoption of some uniform system in directing the manufacturing optician, in making clinical records, etc., they are not agreed as to the system which should be recommended by the Section. We are therefore under the necessity of presenting also a minority report.

The committee have considered three systems:

1st. That in most general use in this country, in which zero is placed at the end of the horizontal meridian to the patient's left and the degrees are counted in the upper semicircle to 180° at his right.

2d. That in which zero is placed at the top of the vertical meridian and the degrees are counted right and left, or rather to the nasal and temporal sides, to 90° at the horizontal meridian.

3d. That in which zero is placed at the nasal extremity of the horizontal meridian, in each eye, and the degrees are counted on the upper semicircle to 180° at the temporal extremity.

We find the first system subject to the following objections. 1. That it fails to show at a glance the interesting fact of the symmetry or asymmetry of the eyes. While it seems scarcely scientific to compare the nasal region of one eye with the temporal region of the other, this is not merely a theoretical consideration, for statistics show that in eighty per cent of cases of binocular astigmatism the principal meridians are either precisely symmetrical or within a few degrees of being so. When, therefore, we have found the inclination of the axis of the required cylinder in one eye, we know that there are eight chances out of ten of its being exactly or nearly the same, with reference to the nasal and temporal sides, on the other. 2. The inconvenience resulting from the fact that the terms right and left must be used in a different sense for the patient and for the surgeon. The only advantage claimed for this system is that it is in accord with the numbering of clock dials and the graduation of protractors and other mathematical instruments. The conditions, however, are not the same; in mathematical studies but one person is concerned, and the terms right and left are considered in the direct sense with reference to the observer, while in refraction work two persons are concerned, and these terms are used in the direct sense with reference to the patient. This system is adapted, therefore, only to subjective testing, and introduces an element of confusion into any kind of objective examination.

The second system, with zero at the top of the vertical meridian, has a very obvious relation to the symmetry of the eyes, but is liable to the objection that the numbers are duplicated and require some sign, such as "n" and "t," to distinguish them.

The third system, with zero at the nasal extremity and 180° at the temporal extremity of the horizontal meridian in each eye, seems to us to be free from the above objections, and we would report in favor of recommending its adoption, but at the same time expressing a willingness to conform to any plan that may seem most likely to become universal.

WM. THOMSON.
GEO. C. HARLAN.

MINORITY REPORT.

After careful consideration of the views of my colleagues on the committee I have been unable to join them in their recommendation.

Before abandoning the method with which we are familiar, and which is in almost universal use in this country, we should carefully consider its advantages and scrutinize the objections that have been urged against it.

In the first place it is not only the established and well understood method in this county, but it is based upon principles with which we have been familiar since our earliest school days, and is intimately embodied in the work and records of all scientific investigation, where the circle is a rudimentary factor in the processes employed. In our first introduction to mathematical studies we found on the protractor the left-hand end of the horizontal line designated as zero and the degrees of linear development on the arc of the circle counted upward by right ascension after the manner of the astronomer. The same method has been employed in graduating the quadrant, sextant, and the meridians as employed by the geographer and astronomer. In a word, in all the sciences where the circle is introduced the eastern, or left-hand, end of the horizon line has been adopted as the starting-point and the degrees counted upward by right ascension to the zenith. This method is indissolubly joined to the records of the mathematical sciences, and is readily understood by all. When direction is given to place the axis of a cylinder at, *e. g.*, 30°, no reference being had to spectacles, there is not an optician in the world who would not place it as desired, since it would be plainly indicated on his protractor. No one outside the realm of ophthalmology would ever think of getting behind the protractor, and thus reversing the angle. We should therefore hesitate before we divorce our ophthalmological records from a method employed universally among scientific men laboring in other fields.

If we adopt the median line of the face as zero, we not only separate ourselves from this universally understood method of estimating degrees, but it will be necessary to keep in mind a right and left ascension and we can never be sure that it will be understood without explanation, except by the initiated. In my judgment this will introduce complexity. In place of conceiving under all circumstances, a development upon the circle from left to right, we shall be compelled to conceive a development from right to left for the patient's right eye, and left to right for the left eye. At this point added confusion is introduced by the fact that our trial frames are inverted semicircles which brings the zero of their graduation to the temple side of the patient's face, and subjects one to a constant necessity for mentally reversing the frame.

The real cause of confusion, if any, in the system we now employ is in referring the angles of deviation to the respective eyes of the patient, whereas it should, as in other things, be compared to the horizon line. Personally, I have not found difficulty in doing this, *i. e.*, in viewing the angle from the standpoint of my patient. This presents no more difficulty than in differentiating between the patient's right and left eye, examining them from the front as we usually do, the right eye being opposed to our left. This process of orientation is one we must perform in many of the details of life.

With regard to the symmetrical placing of the meridians in the two eyes, etc., I can see no practical advantage in referring them to the median line of the face, that does not obtain equally for the universal horizon line.

S. D. RISLEY.

After considerable discussion of the reports the Society failed to reach a satisfactory conclusion and the subject was indefinitely postponed.

SYSTEMATIC REPORT ON THE PROGRESS OF OPHTHALMOLOGY DURING THE THIRD QUARTER OF THE YEAR 1892;

BY DR. ST. BERNHEIMER, IN VIENNA; PROF. HORSTMANN, IN BERLIN; AND DR. SILEX, IN BERLIN;

WITH THE CO-OPERATION OF

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Sections I.–XI. Translated by Dr. WARD A. HOLDEN.

Sections I.–V. Reviewed by DR. ST. BERNHEIMER.

I.—GENERAL OPHTHALMOLOGICAL LITERATURE.

TEXT-BOOKS, MONOGRAPHS, AND TREATISES ON GENERAL, BIBLIOGRAPHICAL, AND HISTORICAL SUBJECTS.

STATISTICAL REPORTS.

228. TROUSSEAU. The causes of blindness in the patients of the Quinze-Vingts. *Arch. d'Opht.*, vol. xii., 4, p. 268.

229. KUSCHEW. Blindness and its causes in non-Russian inhabitants of the colony Staro-Slavkin in the district of Sarcatow. *Wjestn. Ophthal.*, 1892, 4.

230. DE WECKER and MASSELON. Clinical ophthalmoscopy, 2d ed., pp. 396, and 80 photographs; Doin, Paris.

231. DE WECKER. A point in the history of ocular surgery. *Soc. franç. d'Opht.*, 1892.

232. TROUSSEAU. Hygiene of the eye. Masson et Gauthieu, Paris, 1892.

233. Report of the committee on the efficient control of railway servants' eyesight. *Brit. Med. Jour.*, July 23, p. 194.

TROUSSEAU (228) gives a report on the causes of blindness in 627 hospital patients, modelled after the report of Magnus. The predominating causes were atrophy of the optic nerve, found in 129, and blennorrhœa neonatorum, found in 30; next glaucoma and irido-choroiditis. Blindness from injury was more frequent than in Germany. Of general diseases causing blindness, tabes, syphilis, and the acute infectious diseases of childhood which favor the development of scrofula were the most frequent. In 308, almost half the cases, the blindness was preventable.

V. MITTLESTÄDT.

In a colony of 4,844 individuals, KUSCHEW (229) found 50 cases of blindness, or 19.3 to the thousand. 82 % were due to trachoma mostly with trichiasis, 6 % to measles, 2 % to blennorrhœa, 4 % to glaucoma, and 4 % to cataract. HIRSCHMANN.

DE WECKER (231) has discovered that the cataract knife, the invention of which is commonly attributed to A. von Graefe, was used by Tenon in cataract extraction and is pictured in his *Mémoires et observations sur l'anatomie, la pathologie et la chirurgie* Paris, 1806. SULZER.

TROUSSEAU'S (232) compendium presents very completely the present status of the hygiene of the eye. In the first portion, devoted to the ætiology of blindness, statistics of the asylum of Quinze Vingts are given. A second section treats of the influence of climate and race upon eye diseases. In the chapter on school myopia Trousseau speaks against the adoption of the vertical handwriting, as being too slow for practical purposes. The demands made on the eyes by the army, the navy, and the railway are fully treated of, as well as the occupations which are injurious to the eyes. An interesting section is that on the influence of heredity and consanguinity upon diseases of the eye.

SULZER.

The report (233) consists of two parts: (A) historical and (B) relating to the work of the committee, including information obtained from 48 railways, critically reviewed under the following heads: (1) The classes of men examined; (2) the examiners; (3) the methods of examination for distant vision and for color sense; (4) the arrangements for re-examination; (5) the neglect of examination. It concludes with numerous recommendations.

WERNER.

II.—GENERAL PATHOLOGY, DIAGNOSIS, AND THERAPY.

234. PANAS. Report to the Academy of Medicine on the communication of Dr. Landolt entitled "On the abuse of mercury in the treatment of diseases of the eyes." *Arch. d'opht.*, vol. xii., No. 5.

235. VIBERT. Intramuscular injections of mercury in ocular therapeutics. *Thèse de Paris*, Steinheil ed., 1892.

PANAS (234) opposes Landolt's warning against the use of mercury in other than specific eye diseases. Panas has seen the best results from the use of mercury in non-specific diseases of the uveal tract when all other remedies had failed.

Panas has discarded enunctions of gray ointment (which is not absorbed through the skin, but from inspiration of the vapor into the lungs) on account of the inexact dosage and the stomatitis produced, and also the administration per os. In place of these methods he employs intramuscular injections of 4.5 *mgr* of biniodide of mercury in sterilized olive oil, which are well borne and cause neither local symptoms nor stomatitis.

V. MITTELSTÄDT.

VIBERT (235) believes that of all the mercury salts the biniodide is the most efficacious and causes the fewest unpleasant symptoms. He injects 0.4 of biniodide in 100 of sterilized olive oil with a Pravaz syringe.

III.—INSTRUMENTS AND REMEDIES.

236. CHISOLM. Resection of the optico-ciliary nerves. *Journ. Amer. Med. Ass.*, 1892.

237. WOODWARD. The ophthalmometer of Javal and Schiötz and the diagnosis of astigmatism. *N. Y. Med. Journ.*, 1892.

238. GUTTIEREZ-PONCÉ. Presentation of a scotometer. *Soc. d'opht. de Paris.*, March 8, 1892.

239. PARENT. A refraction ophthalmoscope with cylindrical lenses and a mirror of varying focus, which may serve as a complete optometer. *Ann. d'Oculist.*, vol. cvii., 3, p. 19.

240. PITOU. A new campimeter. *Ann. d'Oculist.*, cviii., p. 3.

241. GALEZOWSKI. The magnification of the ophthalmoscopic image in the examination of the retinal vessels. *Rec. d'opht.*, 1892, No. 9, p. 385.

242. STROHSCHEIN. On the sterilization of atropine, eserine, and cocaine solutions, with a description of a new drop glass. *Graefe's Arch.*, xxxviii., 2, p. 154.

CHISOLM (236) has performed optico-ciliary neurotomy in eighty-five cases for the relief of pain and the preservation of the eyeball, and in the majority of cases the results have been satisfactory. His method of operation is very simple. He opens the conjunctiva at the outer or inner canthus, and passes blunt scissors through the opening back until he feels the optic nerve. This is then divided and the neighboring tissues thoroughly separated. The hemorrhage is stopped by compression. The extensive ecchymoses disappear in a few weeks. If the eye is not disfigured, he prefers this operation to enucleation. He does not consider the operation dangerous. BURNETT.

WOODWARD (237) gives a tabular report of the examination of eighty-eight corneæ with the Javal and Schiötz ophthalmometer. He finds, as all careful observers have found, that the corneal astigmatism is, on the average, half a dioptry greater than the total astigmatism. The ophthalmometer is not infallible, nor are the data furnished by its use always correct. BURNETT.

GUTTIEREZ-PONCÉ (238) places a series of luminous discs of various colors, and ranging in diameter from 1-8 *mm*, one metre from the patient. As soon as the image of the disc observed exceeds the size of the amblyopic spot in the retina, the color of the disc is perceived. SULZER.

By adding a lens of + 25 D, and one of — 25 D, the focal distance of which may be varied at will, to the concave mirror used in the upright examination, PARENT (239) is able to vary the total focal distance within the limits 8 *cm* and ∞. The coating of the mirror is removed in parallel lines, through which the light from the fundus observed passes to the observer's eye. The horizontal vessels of the observed ametropic eye appear single only when the observer's eye is accurately focused for them (principle of Scheiner's experiment). This clever modification of the objective determination of the refraction renders a high degree of accuracy possible.

A specially ground cylindrical mirror may be made to correct the astigmatism of the observer. SULZER.

PITOU has constructed a transmitter by the use of which the results obtained with the campimeter may be reduced to degrees. It is thus possible to record observations on the ordinary visual field blanks which represent the projection of a hemisphere. The dimensions of the reduced campimetric visual fields are not dependent upon the distance at which they are taken, and are as accurate as when the field is taken with the perimeter. Pitou's instrument enables us to replace the cumbrous and expensive perimeter with a simple black chart. SULZER.

According to GALEZOWSKI (241) the magnification usually obtained with the upright image is not sufficient to enable us to recognize the finer changes in the retinal vessels. By placing 3 × lenses of 10,15, and 20 D, respectively, at their focal distances behind the mirror, he obtains a magnification of 60 diameters. With this ophthalmomicroscope, Galezowski has recognized an endarteritis with small arterial hemorrhages, in a case of thrombosis of the central artery. SULZER.

STROHSCHEIN (242) repeated the experiments of E. Franke in regard to infection and disinfection of collyria, and on the whole confirmed them. The ordinary dropper can be sterilized only with a steam sterilizer. The author describes a new dropper which may be held in an ordinary flame and thus glass and contents be thoroughly sterilized in a short time. The droppers are made in different colors for different solutions.

IV.—ANATOMY.

243. BOGROW. The third root of the optic nerve from the optic thalamus. *South Russian Med. Journ.*, No. 3.

BOGROW (243) experimenting in Prof. Flechsig's laboratory in Leipsic, discovered a root of the optic nerve, hitherto undescribed, which passes from the base of the thalamus into the optic tract in the region where the latter lies on the base of the brain, near the tuber cinereum. The author believes these fibres to be the path of the pupillary reflex. The fibres may extend from the thalamus to the posterior commissure and the corpora quadrigemina (the oculomotor nucleus for the pupils).

HIRSCHMANN.

V.—PHYSIOLOGY.

244. DUFOUR. On the perception of colors. *Soc. franç. d'opht.*, 1892.

245. Tscherning. The spherical aberration of the human eye. *Soc. franç. d'opht.*, 1892.

246. MacGillivary. Report of case of central color defect, with remarks. *Brit. Med. Journ.*, July, 1892.

247. Mackay. On the quantitative estimation of the color sense. *Brit. Med. Journ.*, Sept., 1892.

248. Bickerton. On the association of shipping disasters with color-blind and defective-sighted sailors. *Brit. Med. Journ.*, Sept., 1892.

249. Straub. An instrument for the determination of convergence power and the position of rest of the eyes. *Opht. Review*, vol. xi.

250. Story. The light streak on the retinal vessels. *Opht. Review*, xi., p. 100.

251. Tscherning. Contributions to the dioptrics of the eye. *Zeitschr. f. Psych. und Phys. der Sinnesorgane*, vol. iii., part 6.

Dufour (244) examined a case of complete color blindness in which the maximum of intensity lay in the greater part of the spectrum. At the warm end the spectrum was shortened, and at the cold end of decreased intensity. Dufour believes that these facts accord better with the Young-Helmholtz theory than with the Hering theory. Sulzer.

Tscherning (245) found by Thomas Young's method that 50 per cent. of eyes are aplanatic. Of the other 50 per cent., the majority have positive spherical aberration, while some few have undoubtedly a negative spherical aberration. This difference may be fully explained by the variations in the form of the cornea which Sulzer has described.

Tscherning has also been able to confirm the proof furnished by Thomas Young that in accommodation the positive spherical aberration is corrected, or over-corrected. Sulzer.

MacGillivary's (246) patient, a young girl, had normal visual acuteness, and recognized colors perfectly, according to Holmgren's test, but had a very small central scotoma for red and green and was unable to distinguish red and green railway signals at a distance of 300 yards. Werner.

Mackay (247) speaks of the varying results obtained by different observers and of the difficulty of establishing a normal standard. In the report of the Committee on Color-Blindness (Brit. Med. Asso.) no attention was paid to the quantitative perception of color. Werner.

Bickerton (248) in a long paper on practical points states that all witnesses in cases of naval disasters should undergo an examination as to their visual acuteness and color perception, a suggestion which had been already made by the Committee on Color-Blindness and laid before the Royal Society.

Story (250) reviews the theories of Jaeger, Young, and Schneller which explain the light streak by reflection from the blood column, the fundus, and the convex wall of the vessel. He considers Young's theory incorrect, and on the ground of experiments and of clinical experience approves the third theory, that of Schneller. Werner.

Tscherning (251) adds three new reflex images to the three Purkinje-Sanson images already known, demonstrating their existence by an apparatus and by mathematical calculation. The six reflexes have their origin as follows: 1. From the anterior surface of the cornea; 2. from the posterior surface of the cornea; 3. from the anterior surface of the lens; 4. from the posterior surface of the lens; 5. an image from double reflection from the surfaces of the cornea, only subjectively visible; 6. a second subjective image just anterior to the retina, already described by Coccius. With his ophthalmophakometer the author was able to compute all the constants of the eye with the exception of the indices of refraction. His results corresponded closely with those of Helmholtz. He found the thickness of the lens 0.45 *mm* greater.

Sections VI.–XI. reviewed by Dr. HORSTMANN.

VI.—ERRORS OF REFRACTION AND ACCOMMODATION.

252. Herrnheiser. The development of the refraction of the human eye. *Prager med. Wochenschr.*, 1892, Nos. 19 and 20.

253. Cohn, H. The eyes of musicians. *Berliner Klin. Wochenschr.*, 1892, No. 12.

254. Pymsza. Comparative studies on the relation of the refractive condition to the structure of the skull. Inaug. Dis., Dorpat, 1892.

255. Stephenson, S. A note upon the relative frequency of myopia among Christians and Jews. *Ophth. Rev.*, vol. xi., p. 110.

256. Falkenburg. On the normal refraction and its natural course. Utrecht, 1892.

257. VALUDE. High myopia. Extraction of the healthy lens. *Soc. d'opht. de Paris*, Jan. 5, 1892.

258. TRUE. Surgical treatment of myopia and keratoconus. *Montpellier méd.*, 1892, No. 9.

259. JACKSON. Manifest and latent hyperopia. *Jour. Amer. Med. Asso.*, 1892, Aug. 27th.

266. TSCHERNING. The influence of the posterior surface of the cornea on the refraction of the eye. *Soc. franç. d'opht.*, 1892, May.

267. STRAUB. On muscular asthenopia. *Dutch ophth. Soc.*, 1892.

268. BULL. The relation of the irregular contraction of the ciliary muscle to astigmatism. *Soc. franç d' opht.*, 1892, May 2d.

269. BULL. Asthenopia from astigmatism. *Ibid.*

270. GALEZOWSKI. Monocular diplopia. *Soc. de Biologie de Paris*, 1892, p. 309.

271. WÜRDEMANN. What may be considered normal corneal astigmatism? from kerato-metric measurements of 300 eyes. *Journ. Amer. Med. Asso.*, Aug. 27, 1892.

272. REYNOLDS, D. S. Gradation of lenses. *Journ. Amer. Med. Asso.*, Aug. 27, 1892.

273. DAVIS, A. E. Javal's ophthalmometer and atropine in determining errors of refraction. *N. Y. Med. Journ.*, Sept. 10, 1892.

274. LAMBERT, W. E. Retinoscopy as a means of estimating astigmatism. *N. Y. Med. Journ.*, Aug. 27, 1892.

275. SPALDING, J. A. A few words on Donders' violet test for the detection of errors in refraction. *Annals of Ophth. and Otol.*, July, 1892.

276. RISLEY, S. D. The relative importance of astigmatism in the production of asthenopia. *Annals of Ophth. and Otol.*, July, 1892.

277. TILLEY, ROBERT. Monocular diplopia. *Journ. Amer. Med. Asso.*, Sept. 10, 1892.

HERRNHEISER (252), systematically examined over 11,000 eyes at various ages. 1,918 eyes of new-born infants were all hyperopic, 2.3 D on the average. Of 546 eyes in children between one and six, 24 were myopic, 130 emmetropic, and 392 hyperopic. The average hyperopia was 1.95 D. 3,826 eyes were examined between six and twenty, in these the proportion of myopes increased from year to year. Between twenty and seventy, a change in refraction is rare. Myopia increases regularly until the twentieth year, and again in old age, the latter increase being due to senile changes in the lens. A decrease in refraction almost never occurs. The author could not verify Stilling's rule that a low orbit favored myopia. The higher degrees of hyperopia are congenital and change but slightly in the course of years.

COHN (253) found in 62 musicians, 25 emmetropic, 3 hyperopic, 8 astigmatic, 6 amblyopic, and 20 myopic. Of the myopes, 9 were myopic when at school, and only in 6 was the myopia possibly due to their profession. Cohn does not consider Stilling's view proven, that looking downward in reading music causes myopia.

PYMSZA (254) in 338 scholars, mostly of Esthic nationality, found 17.9 % of myopes. Since these people have broad faces and low orbits, and the proportion of myopes is less than in the inhabitants of Western Europe, Stilling's theory cannot be correct. The development of myopia depends on the demands made upon the eyes in modern civilization, and not upon the form of the cranium.

STEVENSON (255) found that in a school of Jews and Christians mixed, there were 10 % of Jews myopic and 1.9 % of Christians. The figures are only approximate as in some cases myopia was only presumptive. WERNER.

According to FALKENBURG (256) the typical refraction of the new-born infant is hyperopia 2 to 4 D. This hyperopia is gradually reduced to 1 to 1.5 D, which is the normal hyperopia. By a strain of the ciliary muscle this hyperopia in middle life appears as emmetropia, and is only revealed by repeated atropinization. In old age 1 to 1.5 D again becomes manifest. In many cases of amblyopia there is manifest hyperopia, which is slightly greater than the normal latent hyperopia. Atropinization shows that this manifest hyperopia is the total hyperopia.

VALUDE (257) in a myope of ten, extracted the lens in one eye and made discission in the other. The visual acuteness was raised from $\frac{1}{8}$ to $\frac{1}{6}$. Discission is preferable to extraction in such cases.

SULZER.

TRUE (258) recommends discission or extraction of the lens in high myopia. SULZER.

As a result of his investigations JACKSON (259) has found that the latency of hyperopia is essentially exceptional, inconstant, and abnormal, and that it is not more frequent or greater in childhood than in adult life, and the practical inference is that it is usually unnecessary to employ a mydriatic to unveil the latent hyperopia when the proper means of detecting hyperopia have been employed. This consists essentially in over-correcting the manifest hyperopia and then gradually reducing the + glass by an added cylinder in testing. BURNETT.

TSCHERNING (266) calls attention to the fact that the difference between the refractive index of the cornea and that of the aqueous is greater than is commonly supposed, and that therefore the posterior surface of the cornea cannot be neglected in the dioptrics of the eye. With his ophthalmophakometer the author found the radius of curvature of the posterior surface of the cornea to be on the average 6 *mm*. It usually shows a vertical astigmatism, but as it is a concave surface the result is an astigmatism against the rule. Tscherning's attention was directed to this fact by a case having a subjective horizontal astigmatism of 1.5 D while the corneal astigmatism was only 0.5 D. Measurement of the anterior and of the posterior surface of the lens showed that the discrepancy could not be explained by lenticular astigmatism. There remained then only the posterior surface of the cornea, and direct measurement of its radii of curvature in fact partially explained the circumstances. SULZER.

STRAUB (267) calls fatigue of the extrinsic muscles muscular asthenopia. By examining the position of rest for distance and for near with his apparatus, he determines whether binocular vision is maintained with difficulty. With Hering's test of the falling balls he determines binocular vision quantitatively. In anisometropia he carefully corrects each eye. When an operation is indicated he prefers capsular advancement to tenotomy. WESTHOFF.

BULL (268) believes that all the arguments hitherto advanced in support of the existence of asymmetrical contraction of the ciliary muscle, are inconclusive. SULZER.

BULL (269) explains the fact that not all astigmatic persons have asthenopia, by the different disturbances of vision that occur in the various forms of astigmatism. SULZER.

GALEZOWSKI (270) observed several cases of hysterical spasm of accommodation, in which the accompanying symptoms, monocular diplopia and anæsthesia of the retina, disappeared after the use of atropine, or of glasses correcting the symptomatic myopia. SULZER.

WÜRDEMANN (271) has found, as have most observers, that the *cornea* is seldom free from astigmatism, not often however over 0.75 D or less than 0.25. His statement that the decrease in curvature from the apex to the periphery of the cornea is greatest in the vertical meridian, is totally at variance with the measurements of the Reporter. According to my measurements the nasal side of the horizontal meridian invariably diminishes most rapidly in refraction towards the periphery. BURNETT.

REYNOLDS (272) reviews his proposition made some years ago to number lenses, not by their focal length but by their angle of refraction expressed in degrees and fractions. BURNETT.

Indirectly DAVIS' (273) paper is pernicious and is liable to bring discredit upon JAVAL'S most valuable instrument by over-enthusiasm and claims for it that cannot be substantiated. "Atropine has had its day of usefulness in ascertaining errors of refraction. The ophthalmometer has replaced it in the offices of many oculists, and I predict, with others, that it will almost wholly take the place of the old method of testing with atropine before a great while elapses."

The ophthalmometer has occupied an important position in my office for as long a time (seven years) as in that of any other oculist in this country, I fancy, and it has not yet succeeded in running a mydriatic out altogether. It has, however, given me more certain indications for it, and so it will for others when sufficient experience and a thorough knowledge of what the ophthalmometer really does shall have taught them the true function of the instrument. BURNETT.

LAMBERT (274) is a strong advocate of the shadow test, and believes it to be as accurate as any objective test we have. He prefers, as we believe all workers now do, the plane mirrors.
BURNETT.

SPALDING (275) calls attention to the test for ametropia by causing the patient to look at a bright light through a violet-colored glass, which was recommended by Donders in his treatise and which seems not to have come into use. He has found it serviceable.
BURNETT.

RISLEY (275) contends for the emmetropic eye as the standard eye even though it be not the prevailing eye, and for the presence of hypermetropia as a sole factor in the production of asthenopia in a large percentage of cases. BURNETT.

TILLEY (277) has seen three cases of monocular diplopia and from a study of these and the other reported cases he is inclined to accept as most plausible the theory of Fontan, viz., that the impressions received by each eye are transported to the right and left hemispheres respectively, and that they are fused by some communicating nerve fibres. When there is any disturbance in this communication there is monocular diplopia. BURNETT.

VII.—LIDS.

278. FLACK, J. On sarcoma of the lids. Inaug. Dissert., Königsberg, 1892.

279. BOCK. Pediculi capitis on the lashes. *Centralbl. f. prakt. Augenh.*, 1892, p. 259.

280. KRÜDENER. A contribution to the pathological anatomy of amyloid tumors. Inaug. Dissert., Dorpat, 1892.

281. DA GAMA PINTO. Contributions to ocular surgery. *Annal. d'Ocul*, cvii., p. 241.

282. SMITH, E. A new operation for trichiasis distichiasis and entropion of the upper lid. *Amer. Med. Asso.*, 1892, Aug. 27th.

283. SCOTT, K. Operative treatment of infantile ectropion. *Ophthal. Rev.*, xi., p. 108.

284. VERNEUIL. Restoration of the upper lid by epithelial grafts. *La Clinique*, 1892, Dec. 3d.

284a. EVANS, T. C. Congenital ptosis, report of a case treated by Panas' operation. *Amer. Journ. of Ophth.*, August, 1892.

BOCK (279) found in two children a scaly blepharitis due to pediculi capitis. The affection was cured by the use of gray ointment.

KRÜDENER (280) examined microscopically eight cases of amyloid tumor from the palpebral conjunctiva, and gave a detailed description of their histological structure.

SMITH'S (282) operation consists in splitting the edge of the lid as in the Jaesche-Arlt operation, and then touching the hair follicles or the tarsus with the point of the galvano-cautery or the Pacquelin cautery. BURNETT.

SCOTT (283) introduces silver-wire sutures into the substance of the everted lids, in cases of neglected purulent ophthalmia of infants, which are allowed to remain in situ for six days, the wire acting as a splint to keep the lids in position. WERNER.

VIII.—LACHRYMAL APPARATUS.

285. GAMO PINTO. Treatment of affections of the lachrymal sac. *Annal. d'Ocul.*, cvii , p. 25.

286. TERSAN. Curetting of the lachrymal sac without cutaneous incision. *Annal. d'Ocul*, vii , p. 262.

287. THOMAS, Ch. H. Stricturotomy for the radical cure of stricture of the lachrymal duct. Also a stricturotome. *Amer. Med. Asso*, Sept. 10, 1892.

288. HESSE. A contribution to the therapy of chronic disease of the tear sac. Inaug. Dissert., Berlin, 1892.

289. GRÜNBERG. A case of purulent inflammation of the tear sac, complicated with an abscess in the orbit. *Wjest. opht.*, 1892, No. 4, 395.

290. ASCHMAN. Closure of the lachrymal puncta in dacryocystitis as a barrier against infection of a wounded eyeball. *Journ. Amer. Med. Assoc.*, Sept. 10, 1892.

PINTO (285) recommends scraping out the incised sac and cauterization of the canaliculi. SULZER.

TERSAN (286) recommends scraping out the tear sac through the incised upper canaliculus in obstinate dacryocystitis before a cataract extraction is done, when injection is feared, and in similar conditions, in cases of corneal ulcer. SULZER.

THOMAS (287) believes that the only radical cure of stricture of the nasal duct is by stricturotomy, and not by gradual dilatation, and for this purpose has devised a stricturotome. This consists of a knife with a cutting blade 7 *mm* in length and 3 *mm* in width, with a blunt point in the form of a probe and dilator. This latter renders it sure of introduction, and serves to protect the soft parts in the vicinity of the stricture. After the stricturotomy he usually introduces a leaden style to be worn for a few days, till healing is accomplished. BURNETT.

When the treatment of tear sac disease by means of probes is not successful, HESSE (288) extirpates the sac. The operation always gives a good result.

According to GRÜNBERG (289) an orbital abscess was in direct connection with the blennorrhoic tear sac, and discharged when the latter was opened. Vision was lost. HIRSCHMANN.

ASCHMAN (290) recommends the closure of the puncta lachrymalia by means of the galvano-cautery in cases of wounds of the cornea where there is existing dacryocystits. He believes this will prevent infection, and reports three cases where it has been tried in addition to other means. BURNETT.

IX.—MUSCLES AND NERVES.

291. VAN MILLIGEN. A contribution to the operative treatment of strabismus sursum et deorsum vergens. *Centralb. f. prakt. Augenheilk.*, 1892, 327.

292. VAN MILLIGEN. The anomalies of convergence. *Annal. d'Ocul*, cvii., p. 12.

293. GULLSTRAND. Differential diagnosis and photographic representation of ocular paralyses. *Hygiea*, liv.

294. DE SCHWEINITZ. Post-diphtheritic paralysis of the external recti; with a case. *Annals of Oph. and Otol.*, July, 1892.

295. HELFRICH. Paralysis of the muscles of one eye following an injury to the other. *Journ. of Oph., Otol., and Laryngol.* July, 1892.

296. BLOCQ and GUINEAU. Conjugate paralysis of the sixth pair. *Rev. des sciences méd.*, 1892, p. 120.

297. COPPEZ. A case of labio-glosso-pharyngeal paralysis. *Soc. de méd. et mat. de Bruxelles*, Oct., 1891.

298. SAVAGE. Insufficiencies of the oblique muscles and how to correct them. *Journ. Amer. Med. Assoc.*, Sept. 17, 1892.

299. PRINCE. The fourth-degree prism in the correction of hyperphoria. *Ibid*, Aug. 27, 1892.

300. STEVENS. Facial expression as influenced by the ocular muscles. *Ibid.*

301. CONNOR, LAERTUS. Heterophoria as a cause of acute rhinitis, loss of smell, and tinnitus aurium. *Ibid.*, Sept. 10, 1892.

VAN MILLIGEN (291) operated on a case of alternating sursum et deorsum vergens by advancing the left inferior rectus and tenotomizing the right superior rectus. The cosmetic result was good, but binocular vision was not obtained.

VAN MILLIGEN (292) described four additional cases of paresis of visual convergence and also two cases of paresis of voluntary convergence. He concludes from his observations that paralysis of convergence is usually due to alcoholism, and mostly associated with toxic amblyopia. SULZER.

GULLSTRAND (293) presents a new method of diagnosing ocular paralyses objectively by the corneal reflexes, and illustrates his description with a number of photographs. The procedure is as follows : The patient stands opposite a window at 3 *mm* distance, and the observer stands before him with his back to the window. The patient fixes the nose of the observer constantly, and moves his head up and down, to the right and to the left, while the observer watches the corneal reflex from the window in both the patient's eyes. When the mobility is normal the reflex in all positions of the head covers the pupil, but when there is a loss of mobility in any direction the reflex moves in the pupil in that direction.

A plain mirror may be used to produce the reflex, or a perforated white disc such as the keratoscope may be held before the observer's eye.

For single paralysis, the author gives the following table :

A. With horizontal asymmetry when the patient looks to his right.	there is : A. Paralysis of the muscle turning the eyes to the right.
1. The reflex in the right pupil being displaced to the right (or in the left pupil to the left).	1. Paralysis of the R. ext. rect. (or weakness of this muscle in fixation with the right eye and secondary deviation of the left).
2. The reflex in the left pupil being displaced to the right (or in the right to the left).	2. Paralysis of the L. int. rect. (or weakness of this muscle in fixation with the left eye and secondary deviation of the right).
B. With horizontal asymmetry when the patient looks to his left.	B. Paralysis of the muscle turning the eyes to the left.
1. The reflex in the left pupil being displaced to the left (or in the right to the right).	1. Paralysis of L. ext. rect (or weakness of this muscle in fixation with the left eye and secondary deviation of the right.)
2. The reflex in the right pupil being displaced to the left (or in the left to the right).	2. Paralysis of the R. int. rect. (or weakness of this muscle in fixation with the right eye and secondary deviation of the left).
C. With a difference in height in looking up when the reflex is higher.	C. Paralysis of an elevator
1 in the right pupil, and the difference in height appears when the patient looks	1. of the right eye.
(α) Right.	(α) of the right superior rectus.
(β) Left.	(β) of the right inferior oblique.
D. With a difference in height in looking down, when the reflex is lower.	D. Paralysis of a depressor
1 in the right pupil, and the difference in height also appears in looking	1. of the right eye.
(α) to the right	(α) of the right inferior rectus.
(β) to the left.	(β) of the right superior oblique.
2. In the left pupil, and the difference in height also appears in looking	2. of the left eye.
(α) to the left	(α) of the left inferior rectus
(β) to the right.	(β) of the left superior oblique

SCHIÖTZ.

In DE SCHWEINITZ'S (294) case, in a boy of four and a half years there was, three weeks after an attack of diphtheria, ptosis of left eye; paralysis of both externi, more pronounced in left; mydriasis on right side; vertical movements good; probably no accommodation. Recovery took place in the following order: Accommodation, and the right external rectus; later the left external rectus. Improvement in the paralysis of the lower extremities came in about six weeks. BURNETT.

In HELFRICH'S (295) case a man of forty-three was struck on the right eye, at the inner canthus most probably, causing a fracture of the lachrymal bones—as there was emphysema—and there was paralysis of all the muscles except the ciliary. There was accompanying this a slight ptosis and ophthalmoplegia of the fellow-eye, there remaining only a slight pupillary reaction.

The patient made a good recovery in about ten weeks.

BURNETT.

BLOCQ and GUINEAU (296) observed a typical case of nuclear paralysis of the abducens. In a case of left hemiplegia without facial paralysis in a man of sixty-two, there was a paralysis of the abducens with a conjugate inaction of the left internal rectus which acted however in convergence, diplopia, dizziness, and a feeling of being drawn to the left.

At the autopsy they found a tubercle of the bulbus, including the right abducens nucleus and the pyramid of the same side without affecting the nucleus of the facial nerve. This renders it probable that the right abducens nucleus sends fibres to the left internus. SULZER.

COPPEZ'S (297) case of bulbar paralysis was complicated with complete ophthalmoplegia.

In cases where SAVAGE (298) has found insufficiencies of the oblique muscles according to his double prism test, he has recently been treating the condition by a shifting of the axis of the cylinder in such a way as to increase the work of the faulty muscle and thus give it a gymnastic exercise. No cases are reported of its good effect. BURNETT.

PRINCE (299) relates some cases of very slight hyperphoria attended with headache and other reflex nervous symptoms which disappeared under the use of a quarter degree prism.

BURNETT.

STEVENS (300) points out the influence which disturbance in the equilibrium of the ocular muscles exercises upon the expression of the countenance. For instance, in exophoria the brows are usually raised; often sharply arched; palpebral fissure often wide; upper lid rather conspicuous; upper lip long; corners of the mouth often drawn up; the mouth curving down in the centre; lower part of the face usually narrow; principal grooves of the face more vertical than with esophoria. And so on for esophoria and hyperphoria. BURNETT.

CONNER (301) reports an instance of esophoria of 12° which was the cause of a rhinitis, loss of smell, tinnitus aurium, and symptoms of general nervous prostration. There was nothing else to which the symptoms could be referred, and they all disappeared permanently when the exophoria was corrected by prisms. BURNETT.

X.—ORBIT.

302. CROSS, F. RICHARDSON. Three cases of empyema of the frontal sinus. *Ophth. Rev.*, vol. xi., p. 221.

302A. MAYDL. Demonstration of a tumor removed from the frontal bone of a girl of fifteen. *Zeitschr. der czechischen Aerzte*, March, 1892.

303. PULVERMACHER, E. Pulsating exophthalmus. *Centralbl. f. prakt. Augenhk.*, 1892, p. 330.

304. MITVALSKY. On cysts of the orbit, with micro- or anophthalmus. *Arch. f. Augenh.*, vol. xxv., p. 218.

305. WEISS, L. On the condition of the orbits in persons with but one eye. *Arch. f. Augenh.*, vol xxv., p. 423.

306. v. NOORDEN. A case of Thiersch transplantation of the entire orbital cavity. *Berl. klin. Wochenschr.*, vol. 92, No. 41.

307. COHN, G. A case of traumatic exophthalmus. *Zehender's klin. Monatsbl.*, vol. xxv., p. 337.

308. JACKSON, E. Ivory exostosis or bony tumor of the orbit. *Jour. Amer. Med. Asso.*, Sept. 10, 1892.

309. DE WECKER. On hernia of the orbital fatty tissue. *Progrès méd*, March 19, 1892.

310. FROTHINGHAM. A case of rare form of orbital tumor. *Jour Amer. Med. Asso.*, Sept. 10, 1892.

CROSS (302) records in the first instance an ordinary case of empyema in a boy aged seventeen, who was almost cured by drainage through orbit, when he was lost sight of. In the second case, a girl aged eighteen, with great distension of the sinus, death resulted from meningitis after an operation involving removal of inner wall of orbit and scraping interior of cavity with a blunt spoon. There was no bone disease and no direct opening into the cranial cavity. The age of the third patient was only thirteen and one half; in his case drainage through the nostril brought about a cure. Case 2 was said to have originated from scarlatina. All recorded cases are over twenty years of age. WERNER.

MAYDL (302A) removed without difficulty an osteoma of the frontal bone weighing 180 *g.*, situated at the inner third of the supraorbital arch. There were several hard nodules on the frontal bone and at the inner canthus and the root of the nose. The entire inner half of the frontal bone was protruding, the eyeball displaced downward and outward, the acuteness of vision somewhat reduced. The mobility of the eyeball was but partially preserved. There were no cerebral symptoms.

The patient did well after the operation. Maydl stated that, of the twelve cases so operated, only two have lived.

PULVERMACHER (303) reports the case of a girl of twelve who had fallen, sustaining a fracture of the base of the skull, after which a left pulsating exophthalmus developed. After ligature of the common carotid the exophthalmus gradually disappeared.

According to WEISS' (305) observations, when the lost eye had been staphylomatous the orbit was larger, and when the eye was phthisical the orbit was smaller. When the ball had been enucleated the orbit was smaller, but when the enucleated eye had been staphylomatous the two orbits were mostly of the same size.

In COHN'S (307) case after a fracture of the inferior wall of the right orbit, an enophthalmus developed, the right eye being sunken 9–10 *mm* behind the level of the left and at the same time being lower.

In JACKSON'S (308) case the tumor appeared at the outer two thirds of the orbit, though its origin was from the upper inner angle. The displacement of the eye was directly forward and downward. There had been no squint or diplopia and no marked weakness of the ocular muscles. The tumor was of ivory hardness but was rather easily penetrated by a hard drill; vision was preserved and the movements of the eye were restored in a few weeks. BURNETT.

De Wecker (309) describes a hernia of the orbital fatty tissue, a protrusion of this tissue under the skin, that in normal and premature senescence is observed chiefly in the lower lid. The relaxation of the tarso-orbital fascia, the partial atrophy of the orbicular muscle, and a general deposition of fat are the causes of this condition. When the protrusion is in the upper lid it causes senile ptosis. The hernia may be of traumatic origin. When the margin of the lid is pressed against the orbital margin the prolapsed fatty tissue is forced back into the orbit, and thus this affection may be distinguished from œdema of the lid.

Sulzer.

Frothingham's (310) case is interesting from the fact that the tumors were of approximately the same size, and occupied exactly the same position in either orbit. These had developed successively since 1890, that in the left orbit first, and came, apparently, from the connective tissue of the orbit. They were of a sarcomatous character with admixture of fibrous tissue.

Burnett.

XI.—CONJUNCTIVA, CORNEA, SCLERA, ANTERIOR CHAMBER.

311. Wolffberg. On the prophylaxis of gonorrhoic ophthalmia in adults, and the therapy of blennorrhœa neonatorum. *Therap. Monatsbl.*, Dec., 1892.

312. Parinaud. Conjunctivitis due to streptococci. *Annal. d'Ocul.*, vol. cvii., p. 88.

313. Muttermilch. Anatomy of chronic inflammations of the conjunctiva. *Ibid.*, p. 328.

314. Westhoff. On the treatment of trachoma. *Dutch Ophth. Soc.*, 1892.

315. Weeks. The surgical treatment of trachoma. *Amer. Med. Assoc.*, Sept. 3, 1892.

316. Chevallereau. Diffuse trachoma. *Soc. d'opht. de Paris*, Jan. 5, 1892.

317. Abadie. Surgical treatment of granular conjunctivitis. *Soc. franç. d'opht.*, May 2, 1892.

318. Viger. A study of granular conjunctivitis in Algeria, particularly in reference to surgical treatment. *Annal. d'Ocul.*, vol. cviii., p. 175.

319. Straub. On the ætiology of the so-called scrofulous inflammations. *Arch. f. Augenh.*, vol. xxv., p. 416.

320. RUMSCHEWITSCH. On hyaline and amyloid degenerations of the conjunctiva. *Arch. f. Augenh.*, vol. xxv., p. 363.

321. BERENGER-FÉRAUD. Note on the kerato-conjunctivitis caused by the venom of a serpent of Senegal. *Arch. de méd. navale et coloniale*, April, 1892.

322. LAGRANGE. On epithelioma of the bulbar conjunctiva, and particularly of the sclero-corneal margin. *Soc. franç. d'opht.*, May 2, 1892.

323. MALGAT. Quadruple pterygium in each eye. *Rec. d'opht.*, 1892, p. 407.

324. WOODS, HIRAM. Diphtheritic conjunctivitis; report of two cases with bacteriological study of the false membrane. *Med. News*, Aug. 20, 1892.

325. WÜRDEMANN. Gonorrhœal ophthalmia through infection by medium of an artificial eye. *Ophth. Record*, Sept., 1892.

WOLFFBERG (311) uses a 4 per cent. solution of alum for cleansing the conjunctiva before employing nitrate of silver.

The affection observed by PARINAUD (312) is characterized by the following clinical signs: marked superficial and deep injection of the conjunctiva, the bulbar conjunctiva often appearing moist; moderate swelling of the conjunctiva; scanty secretion; moderate swelling of the lids. Corneal complications are rare, but iritis is frequent, being mostly associated with an acute or chronic inflammation of the tear sac. The use of van Swieten's solution gave the best results.

The secretion of this conjunctivitis contains many streptococci and pure cultures of this microbe were obtained. SULZER.

The second portion of MUTTERMILCH'S (313) paper describes the development of the follicle and the epithelial changes caused by its growth. The author traces the transition from the subepithelial collections of round cells of acute conjunctivitis to the "characteristic" trachoma follicle. He comes to the conclusion that all follicles are produced by the same anatomical process, and that trachoma is not a distinct form of disease. SULZER.

WESTHOFF (314), after reviewing the various methods of treating trachoma, states that he has obtained the best results by pressing out the follicles with the thumb nails or with Himley's forceps, and then rubbing in: 1000 sublimate solution, or instilling sulphate of copper in 10 % glycerine, or massage with yellow ointment. Excision of the retro-tarsal fold he found unnecessary and always injurious. WESTHOFF.

Weeks (315) gives quite a full history of the various operative procedures that have from time to time been instituted for the radical cure of trachoma. His own experience has led him to the following conclusions: In the first stages the most efficient method is that of expression, combined with superficial scarification and the introduction of a germicide by the use of a brush. In the second stage "grattage" is the best method, combined with expression in some cases. Canthotomy is generally advisable in such cases. Burnett.

Chevallereau (316) presented a man of sixty-three, in whom the conjunctiva of all four lids as well as the left cornea and a portion of the right were covered with hard nodular granulation tissue. Sulzer.

Straub (319), in cases of phlyctenular inflammation, examined the crusts of the accompanying eczema and found in every case the staphylococcus aureus and albus. Inoculation of the rabbit's cornea produced a small vesicle filled with opaque fluid, which lasted four days. The picture was very similar to that of a spontaneous phlyctenula.

Berenger-Féraud (321) report four cases in which the venom thrown a certain distance by a snake found in Senegal produced a severe conjunctivitis and keratitis in man. The snake is black and attains a length of 2 *m.* Sulzer.

Lagrange (322) considers the epithelioma of the limbus to be a malignant neoplasm, and regulates his operative procedures accordingly. Valude in the discussion spoke of several cases of this affection which ran a benign course for a long time.

Sulzer.

Malgat (323) observed a case with four pterygia in each eye. The affection was congenital and so regular that each ball seemed to exhibit a Maltese cross. Sulzer.

From a study of the literature of the subject and from an examination of the pathological products in some cases under his own observation, Woods (324) concludes that there are two forms of membranous conjunctivitis, commonly known as the croupous and diphtheritic, but that they cannot be differentiated clinically since the lids may be soft and uninfiltrated in the diphtheritic form, and hard in the croupous variety. The danger to the eye is always in proportion to the lid complication; the differential diagnosis can be made only from a bacteriological examination, when the presence of the Loeffler bacillus indicates the existence of true diphtheria. Burnett.

Würdemann (325) reports a case where gonorrhœal infection of the conjunctiva of an anophthalmic orbit took place by means of the insertion of an artificial eye. The other eye became affected, and a large corneal cicatrix followed, but some vision was saved by means of an iridectomy and massage, which the author thinks helped in the clearing up of the cornea.

Burnett.

326. Lagrange. Two cases of interstitial keratitis treated by subconjunctival injections of sublimate. *Rec. d' opht.*, 1892, p. 522.

327. Vossius. On parenchymatous keratitis. *Deutsche med. Wochenschr.*, 1892, No. 47, p. 1071.

328. Haltenhoff. Dendritic keratitis or herpes? *Ann. d' Ocul.*, cvii., p. 401.

329. Emmert, E. Dendritic keratitis and herpes. *Centralbl. f. prakt. Augenh.*, 1892, p. 355.

330. Hess. On the cause of striped keratitis after cataract extraction. *XXII. Report of Heidelberg Ophth. Soc.*, 1892, p. 144. (*Folding not infiltration.*)

331. Blanquinque. A case of melano-sarcoma of the cornea. *Rec. d' opht.*, No. 4, p. 92.

332. Chatinière. Sarcoma of the cornea. *Montpellier méd.*, 1892, No. 8, p. 156.

333. Gibson, Robt. Treatment of keratoconus by means of the galvano-cautery and iridectomy. *Journ. Amer. Med. Assoc.*, Sept. 10, 1892.

334. Sulzer. The optical correction of kerataconus, irregular and cicatricial astigmatism. *Annal. d' Ocul.*, cvii., p. 320.

In interstitial keratitis of heredito-specific origin, Lagrange (326) saw rapid recovery after the subconjunctival injection of sublimate, while this treatment was useless in interstitial keratitis of other origin.

Sulzer.

Vossius (327) presented a case of annular parenchymatous keratitis. Two thirds of the cornea were diffusely opaque, and the epithelium was rough. A narrow portion of the periphery of the cornea was transparent. Within the opaque zone there was a grayish-white, intense opaque ring 1 *mm* in width, and at the margin of the diffuse opacity a second smaller intensely opaque ring. The patient, a man of thirty-six, exhibited no sign of syphilis.

HALTENHOFF (328) discusses the question whether the branched keratitis of Hansen Grut and the dendritic keratitis of Emmert are, as Haab believes, identical with Horner's herpes of the cornea. He concludes that besides the frequent herpes of the cornea there is a corneal affection, probably mycotic, similar to herpes in the form of the ulceration, but clinically different. SULZER.

EMMERT (329) believes that dendritic keratitis is not the same as herpes. With the former there is no febrile reaction, and all the patients have a scrofulous dyscrasia. The disease begins as a subepithelial gray opacity, from which branches spread out. The swollen epithelium is cast off. A certain similarity to the form of the infiltration in herpes does not prove the identity of the two diseases.

BLANQUINQUE (331) observed a case of melano-sarcoma of the cornea diagnosed histologically, in which there was no return in six years, after removal, and cauterization of the pedicle with the galvano-cautery. SULZER.

CHATINIÈRE (332) saw a rapid recurrence after the extirpation of a sarcoma of the cornea and cauterization of the stump.

SULZER.

GIBSON (333) gives a case of keratoconus where vision was $\frac{4}{200}$, in which he perforated the apex with a galvano-cautery needle. When the cicatrix finally healed vision was $\frac{20}{100}$, and, after an iridectomy was made, with + 5.5 axis 15, it was $\frac{20}{50}$. The other eye was operated on in the same manner and with an equally good vision, but with — 8.0— 3.0 120°. BURNETT.

The study of the form of the cornea in keratoconus and in certain forms of irregular and cicatricial astigmatism led SULZER (334) to the conclusion that a satisfactory correction of the refractive error could be obtained by a contact glass only. He has had a light contact glass (440 *mgr*) composed of a central spherical portion the size of the cornea and of a scleral ring, ground from a piece of crystal glass. The results obtained encourage further experimentation. SULZER.

MISCELLANEOUS NOTES.

ANNOUNCEMENT OF BOOKS.

1. C. SCHWEIGGER. Lehrbuch der Augenheilkunde. 6th edition. Hirschwald, Berlin, 1893. 510 pages, 33 drawings. The text-book of Schweigger, long and favorably known, also by a translation into English, has, in this 6th German edition, preserved its distinctive features, condensation and clearness in the description of symptoms of disease and of physical and pathological conditions, as well as precision and excellent judgment in the rules for treatment. The functional diseases receive their share of attention, 165 pages. For the objective determination of refraction the author describes the ophthalmoscopic examination in the erect and inverted (Schmidt-Rimpler) images and schiascopy. He describes at length Helmholtz's ophthalmometer, and says that for the determination of astigmatism he prefers the real ophthalmoscopic image to the ophthalmometer of Javal-Schiötz. The specialist will miss many things in Schweigger's book. This is explained in the preface. The present edition has been somewhat reduced in bulk but considerably increased in contents, because the writer has been faithful to his object, not to write a cyclopedia for specialists, but a text-book for students and practitioners. H. K.

2. EMILE BERGER. Anatomie normal et pathologique de l'œil. Ouvrage couronné par l'Institut (Académie des Sciences). 425 pages, 31 figures in the text, and 12 plates. Octave Doin, Paris, 1893. This is a praiseworthy work, clearly written, and most handsomely gotten up, which every progressive oculist will like to have on his shelves for study and reference. Researches in normal and pathological anatomy are so much scattered in peri-

odicals and pamphlets that it is a great convenience to have collected in one volume all that is of importance up to date. The author being so favorably known we need not specially mention that he was the right man for the task. H. K.

3. NEW YORK EYE AND EAR INFIRMARY REPORTS. Vol. I., part 1. Jan., 1893. G. P. Putnam's Sons. Price $1.25.

The N. Y. Eye and Ear Infirmary, the oldest and largest institution of its kind in America, shows its progress not only in the increase of its charitable work, but also in placing the medical experience it furnishes to its staff, students, and visitors at the reach of the profession at large, by publishing, at irregular intervals, a collection of papers based on observations and investigations made in the hospital and laboratory. The first number, consisting of seven ophthalmological and seven otological papers (which will be analyzed in our systematic report on progress), introduces the publication with the following statement:

"The Surgical Staff of the N. Y. Eye and Ear Infirmary, desiring to make known the professional work of the several departments of the Institution, have decided to publish a small volume of original articles which will appear at intervals as material shall be collected.

"PUBLISHING COMMITTEE: Richard H. Derby, M.D., Chairman; Gorham Bacon, M.D.; Frank L. Ives, M.D; William S. Dennett, M.D., Secretary; John E. Weeks, M.D., Editor."

4. G. A. BERRY. Diseases of the Eye. A practical treatise for students of ophthalmology. 2d edition. Lea Brothers & Co., Philadelphia, 1893. Cloth, $8.00. This new edition, revised and considerably enlarged, of Mr. Berry's excellent work, is a handsomely gotten up volume of 745 pages, with 197 illustrations. The book distinguishes itself from other text-books: 1, by the great number (87) of beautifully colored drawings in the text, forming with the uncolored figures a small ophthalmological atlas; 2d, by the mathematical presentation of the laws of refraction of a combined optical system, which are found only in special treatises, such as Helmholtz's *Physiological Optics*, Donders', Mauthner's, and Landolt's treatises on *Refraction*, and in Graefe-Saemisch's *Handbuch*, also Hirschberg's new textbook. The book may be highly recommended. H. K.

SOCIETY MEETINGS.

British Medical Assoc.—Sixty-first annual meeting. New-Castle-on-Tyne, Aug. 1–4, 1893. The section on Ophthalmology will hold its meetings Wed., Thurs., and Frid., Aug. 2d, 3d, and 4th. President, G. E. Williamson, F.R.C.S..; Vice-Presidents : John Walton Browne, M.D.; G. Hartridge, F.R.C.S ; Hon. Secs.: Alfred N. Godby Gibbs, L.R.C.P. Lond., 27 Chandos Road, Bristol ; Archibald S. Percival, M.B. Cantab., 16 Ellison Place, Newcastle-on-Tyne.

Correction.—In the " Progress " of Ophthalmology of the January (1893) issue, No. 202 (Extraction of Foreign Bodies from Eyeballs) should have been attributed to Dr. S. B. St. John instead of Dr. St. John Roosa.

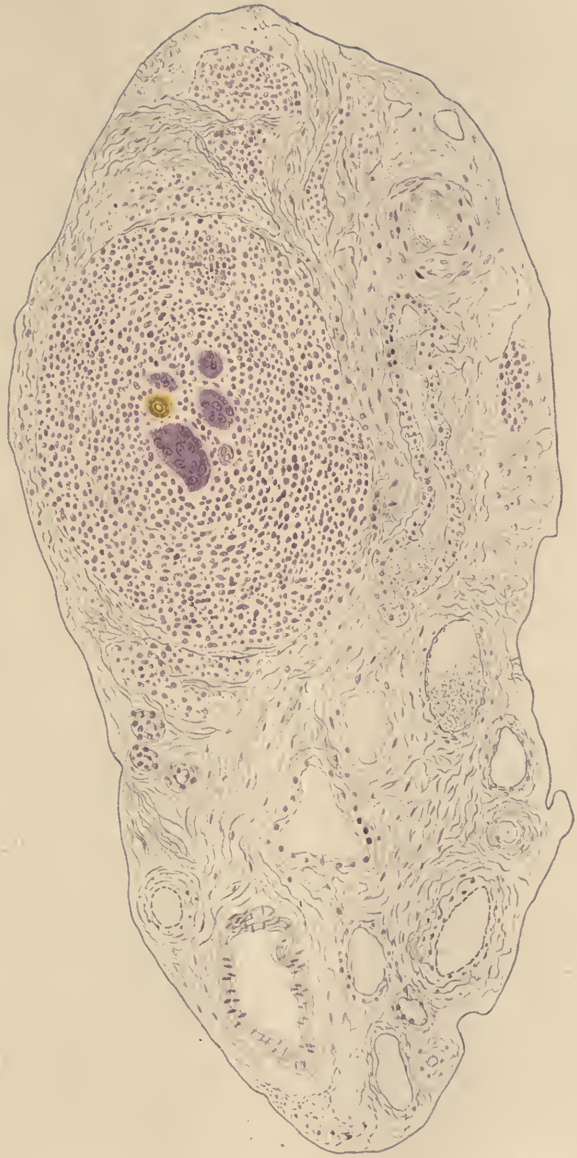

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Fig. 1.

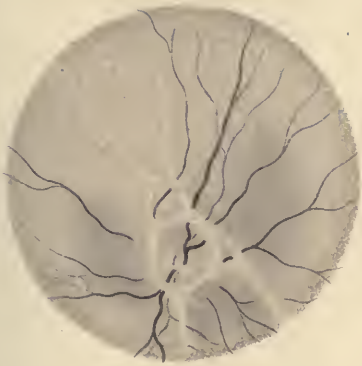


Fig. 2.

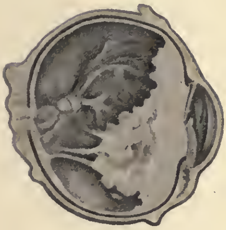
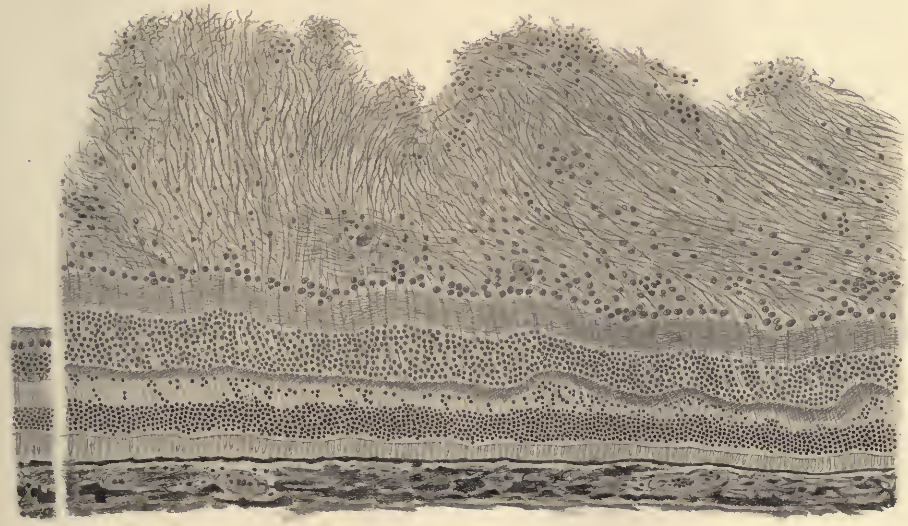


Fig. 3.



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Verlag v. J. F. Bergmann, Wiesbaden.

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VOL. XXII. No. 3.

ARCHIVES OF OPHTHALMOLOGY.

ON THE DEVELOPMENT AND EXTENSION OF ORBITAL SARCOMA.

By Dr. WARD A. HOLDEN.

(*With six figures on a plate.*)

THE frequency with which sarcoma of the orbit recurs, even after apparently thorough removal, and though the tumor be encapsulated, has led me to examine three specimens of recurrent sarcoma with particular reference to the manner of extension. These three cases exhibit fairly well the different starting-points which these growths may have: one springing from the periosteum, and being for the most part fibrous; another having its origin in the cellular tissue of the orbit, and being composed almost entirely of small cells; and the third arising in the choroid and extending back through the optic nerve, forming cellular foci in the dural sheath of the nerve and elsewhere in the orbit.

In all these cases the cells of the younger, developing, portions of the tumor, the sarcoma cells in the infiltrated tissues, and the sarcomatous foci at a distance from the main growth could, for the most part, be traced to the proliferation of the adventitial or the endothelial cells of vessels which were continuous with those of the mass of the tumor.

Case 1 was under the care of Dr. John Dunn, of Richmond, to whom I am indebted for the following history and the tumor removed at the second operation.

Mary O., æt. twelve, employed in a cotton factory, was first seen May 1, 1892. In the previous nine months the left eye had been so swollen at times that it could not be opened. There was no clear history of injury.

St. Pr.—The left eye protrudes 7 *mm*, and its mobility is limited in every direction, and particularly downward. A growth about 6 *mm* in diameter may be felt resting on the inferior orbital wall, and extending back into the orbit. It is hard, adherent to the orbital wall, and not sensitive to pressure.

May 16, 1892.—The outer canthus was cut through and a vertical incision made 20 *mm* down the cheek. The flap so made was retracted and the tumor dissected out. The growth reached back to the sphenoidal fissure and was adherent to the periosteum and the external rectus. It was tough and seemed to have a firm capsule. It measured 15 *mm* by 4 *mm*.

The tumor was examined by Dr. W. M. Gray, of the Army Medical Museum, who made the following report :

"Miliary tuberculosis. The specimen is composed of bands of dense fibrous connective tissue ; between the fibrous bands is a dense lymphoid infiltrate, while throughout the tissue are numerous aggregations of these cells, forming nearly typical miliary tubercles. These cell aggregations differ from miliary tubercles in not containing giant cells. The tissue contains giant cells, however, but they are only found far removed from the tubercles among the cells infiltrating the fibres. Repeated attempts at staining failed to demonstrate tubercle bacilli in the tissues."

Seven months later a tumor could be felt beneath the external portion of the superior wall of the orbit.

March 2, 1893. This growth was removed in several fragments without enucleating the eye. It was similar to the first growth, and adherent to the periosteum. With it were removed the lachrymal gland and a portion of the external rectus muscle.

Microscopic examination of second tumor: The tumor is a fibro-sarcoma, involving the muscle and the lachrymal gland, and in some portions the structure is that of endothelioma. The tumor first removed must be considered sarcomatous. The diagnosis of sarcoma in its Protean forms, is often difficult. Truc (*Nouveau Montpellier Médical*, July 30, 1892) has described a case of sarcoma of the orbit, the histological structure of which led to the erroneous diagnosis of tubercle.

The basis of the second tumor is a dense, laminated fibrous tissue. Some portions are almost entirely free from cellular elements, excepting the nuclei among the fibres.

Other portions contain a considerable number of cells in groups and tracts.

These cells are for the most part rather similar in size and appearance to formative cells, but the groups and tracts are of varying form and size, thus lending a different aspect to different portions of the tumor. The arrangement of the cells, however, is constant and exceedingly characteristic. They form sheaths about blood-vessels of different sizes. The long axis of the cell lies mostly parallel to the axis of the blood-vessel. In parts in which a vessel has been cut longitudinally we find in the fibrous tissue a tract of spindle cells, of varying width, about the vessel. In parts in which a vessel has been cut transversely we find a more or less circular group of cells each round in outline, about the vessel; and where there are several vessels near together the groups of cells are often confluent, constituting a large mass about which the fibrous tissue of the part forms a capsule separating it from others and giving an alveolar appearance to the tumor.

About many vessels in the tumor there is a leucocytic infiltration, these cells often lying near or among the sarcoma cells.

In portions of the tumor some of the transversely cut vessels show about them circular sheaths of cells, while other vessels in the neighborhood are surrounded, not by cells, but by concentrically laminated fibrous tissue. (Fig. 1.) There is no uniformity about these groups. One will be entirely cellular, its neighbor partly cellular, partly fibrous, and the next altogether fibrous with a few spindle-shaped nuclei.

In the portions of the tumor already described the inner coats of the vessels are normal and the new cells have their origin in the proliferation of the adventitial cells. Near the lachrymal gland, however, we find systems of layers of endothelial cells arranged about an empty lumen. (Fig. 2.) The cells have an oval nucleus, the long axis being in a radiating direction from the lumen. It is not possible to say from the appearance whether these cells have arisen from blood-vessels or from lymphatics. Near the lachrymal gland and in its septa are some large vessels with proliferated endothelium blocking the lumen, and having a thickened and almost homogeneous media. (Fig. 3.)

CASE 2.—*History :* Edna O., æt. seven, was seen by Dr. C. E. Rider of Rochester, in May, 1890. Four years before she had fallen and cut the right eyebrow, but there was no history of more recent injury. Two months before, the parents noticed that the right eye was prominent. *St. Pr.*—The right eye is displaced slightly downward, outward, and forward. Mobility unimpaired. A non-adherent tumor may be felt in the upper and inner portion of the orbit.

May 23, 1890.—Dr. Rider removed the tumor. It was nearly spherical, about ½ inch in diameter, lying loose in the cellular tissue of the orbit and not adherent to the periosteum or the muscles. (The tumor proved to be a small-celled sarcoma with a complete thin fibrous capsule.) Six months later a recurrence was noticed. Dec. 29, 1890, a larger tumor and some extra nodules were removed by Dr. Rider. The growth soon recurred and on Feb. 2, 1891, on Dr. Rider's suggestion and with his assistance, an exenteration of the orbit was done by Dr. Knapp. The eye was enucleated, a large lobular tumor involving the muscles was extirpated, and the entire orbital contents removed. Three months later the growth recurred. Growing to a great size it protruded from the orbit and gave rise to frequent hemorrhages. Later it sloughed off and the patient died Aug. 21, 1891.

Microscopic.—The tumor last removed is composed mostly of dense masses of small sarcoma cells. In some portions it shows a myxomatous structure and in other portions are accumulations of giant cells. The muscles are extensively involved and many muscle bundles are atrophied. In one part the tumor has a thick fibrous capsule which is pervaded with capillaries having sarcoma cells about them (Figs. 4 and 5), and the tissues outside the capsule are infiltrated with sarcoma cells.

CASE 3.—L., a man of fifty-six, was seen by Dr. Knapp, February 12, 1892. A year before, detachment of the retina in the left eye had been diagnosed. Six weeks previously the eye had been enucleated on account of irritation. Prof. Prudden, to whom the enucleated eye had been sent, found a melano-sarcoma of the choroid extending down the optic nerve to its cut end.

When seen six weeks after the enucleation there was a little fulness of the orbit, and exenteration was done by Dr. Knapp.

Microscopic.—In the mass composing the orbital contents, three hard nodules were found. One of these proved to be a bit of the optic nerve which had apparently been cut off at the time of enucleation in the effort to divide the nerve far back. The remainder of the nerve was not found.

The bit consisted of a portion of the optic nerve with its sheaths 3 *mm* long. The nerve fibres are atrophied and the connective-tissue septa filled with pigmented and unpigmented sarcoma cells. The pial sheath is not involved, and the intervaginal space is free except at the point where the central vessels pass from the nerve through the dural sheath. Here a continuous mass of spindle cells unites the nerve and the dural sheath. Running in the dural sheath are a great number of small vessels and capillaries with proliferating walls. Here and there are groups of unpigmented sarcoma cells, and at many points dense leucocytic infiltrations. The fatty tissue on the outer surface of the dural sheath shows a beginning sarcomatous infiltration.

The two other nodules are composed of dense fibrous tissue with a sarcomatous infiltration similar to that in the dural sheath.

REMARKS.

The fibrous tissue in the substance of a sarcoma, or forming its capsule or sheath, may have three sources of origin. 1st. It may be simply the previously existing tissue of the part, changed in its relations by the development of the sarcoma cells. 2d. It may be new tissue formed in the usual way by the proliferation of connective-tissue cells, or formative cells, as in ordinary hyperplasia, or in fibroma. 3d. It may be developed by the proliferation of the adventitial cells of vessels, as is shown in Fig. 1.

The fibrous tissue in sarcoma is not important, and our interest centres in the cell development, whether this takes place in new-formed connective tissue, or in that previously existing. This cell development may be considered as it takes place in simple fibrous tissue, and also as it takes place in the modified forms of connective tissue making up the framework of muscle, fat, and acinous gland.

Many sarcomas still show in their older portions evidences of each tract of parallel spindle or of round cells having been developed from the adventitial cells of a vessel. In each of the three cases here described this is more or less clear in the denser portions of the tumor, but it may be particularly well seen in portions in which fibrous tissue is undergoing what is called sarcomatous infiltration. In the thick fibrous capsule limiting a portion of the tumor in Case 2, we find a great number of branching small vessels and capillaries. Here and there about these vessels are irregular groups of spindle cells, the long axis parallel to the axis of the vessel, and the cells evidently developed from the adventitial cells of the vessel. Fig. 4 shows such vessels cut transversely, and Fig. 5 such cut longitudinally. Having passed through the capsule the vessels run into fatty tissue, and here also we find groups of spindle cells.

In the dural sheath of the optic nerve and in the other dense fibrous nodules in Case 3, we find a similar condition. A number of small vessels and capillaries, often apparently of new formation, have groups of spindle cells about them. A vessel may have almost normal walls for a considerable distance, and then a group of sarcoma cells be found far from any other group and far from the mass of the tumor.

When a sarcoma of the ciliary body passes through the sclera following the small vessels of the sclero-corneal junction, we do not have simply a proliferation of sarcoma cells following the path of a vessel, but the specific irritation that produces sarcoma, whatever it may be, causes a proliferation of the adventitial cells of the vessels themselves. This proliferation may vary in degree in different portions of the vessel, and is often most excessive at some remote point, being usually slight in the dense scleral tissue and more marked in the looser subconjunctival tissue.

Although the sarcoma cells themselves may and do divide, as is shown by the presence of multinuclear cells, yet the cells are rarely found at any considerable distance from some vessel, and each tract of cells is of limited lateral extent, apparently indicating that for the most part the cells are produced by proliferation of the cells of the vessel wall, the older cells being pushed farther from the vessel by the development of new cells beneath them, the vessel finally often being compressed or entirely obliterated and the process ceasing for that particular tract.

In adipose tissue, when it is beginning to be infiltrated, we find vessels with sarcoma cells about them lying in the fibrous tissue bordering the adipose. (Fig. 6.) These vessels run out into the delicate fibrous tissue between the fat masses and break up into a delicate meshwork of capillaries. The individual vessels on account of the structure of the tissue can only be followed a short distance. Nevertheless, the sarcoma cells that invade the connective-tissue reticulum may here also be seen often to lie about the wall of larger vessels. As the development proceeds, the entire connective-tissue meshwork is filled with sarcoma cells while the fat spaces remain free.

In muscle the external perimysium forms a barrier for a time to the extension of the sarcoma, and often the growth will surround the muscle completely before entering it. At length we find a few vessels with sarcomatous sheaths in the connective-tissue septa. Then the sarcoma cells in dense masses push in from some point in the periphery between the smaller groups of muscle bundles, and finally fill the entire connective-tissue framework of the muscle, separating the muscle bundles and eventually causing them to atrophy. In this process it is often difficult or impossible to trace the origin of the sarcoma cells, though in some instances they may be clearly traced to the vessels.

The lachrymal gland in Case I is normal in its periphery. In the septa in its interior most of the larger vessels show a proliferation of the endothelium, so that the lumen is often obliterated, and also show a thickened homogeneous media (Fig. 3). Some of the smaller vessels show a leucocytic infiltration about them, and at some points a few sarcoma cells. The glandular tissue proper is unaffected.

In recapitulation we may say in so far as the conditions found in three cases may be generalized, that sarcoma of the orbit develops mostly from the proliferation of the adventitial cells and more rarely of the endothelial cells of vessels; that there may be but a slight proliferation about a vessel for a distance from the main tumor, and then at some point a large focus; and that even dense connective-tissue membranes and capsules offer little resistance to the extension of sarcoma when the vessels of the tumor are continuous with those of the membrane.

Description of the Figures.

FIG. 1.—Transversely cut vessels, one with sarcoma cells about it, others surrounded by new fibrous tissue.

FIG. 2.—Proliferated endothelium about an empty branched lumen.

FIG. 3.—A vessel with proliferated endothelium and degenerating media in a septum of the lachrymal gland.

FIGS. 4 and 5.—A laminated fibrous capsule of a sarcoma, with proliferating capillaries—cut longitudinally in Fig. 4, and transversely in Fig. 5.

FIG. 6.—Beginning sarcomatous infiltration of adipose tissue.

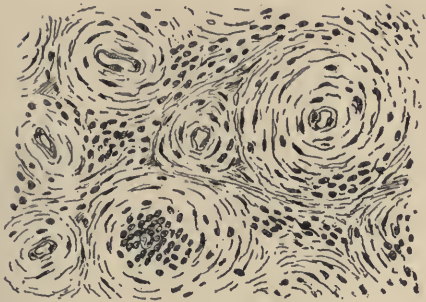

FIG. 1, CASE I.

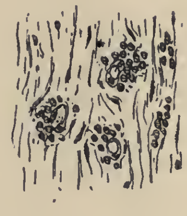

FIG. 4, CASE II.

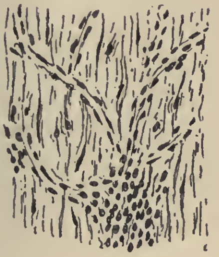

FIG. 5, CASE II.

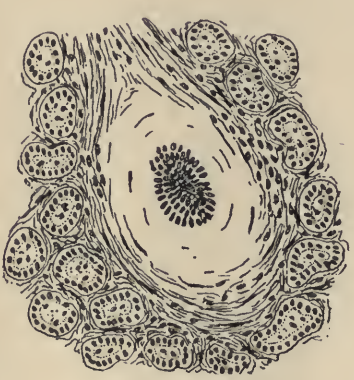

FIG. 3, CASE I.

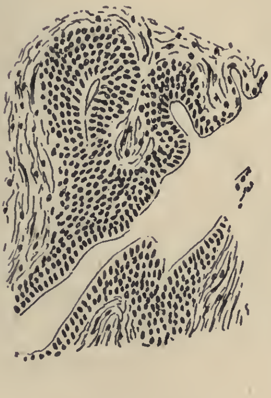

FIG. 2, CASE I.

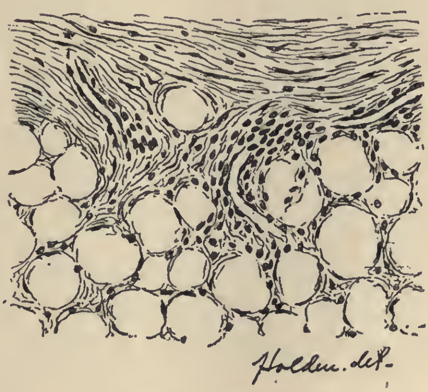

FIG. 6, CASE III.

BACTERIOLOGICAL INVESTIGATIONS WITH REFERENCE TO THE ORIGIN OF SYMPATHETIC OPHTHALMIA.

BY DR. RICHARD GREEFF, OF FRANKFORT-ON-THE-MAIN.

Translated by Dr. ROBERT L. RANDOLPH, of Baltimore, Md.

(*With three figures in the text.*)

THE fact that a traumatic inflammation of one eye can pass over to the fellow eye has been known for a long time. But in spite of numerous observations and experiments we are to-day far from clear as to the exact nature of this inflammation and what track it follows in going from one eye to the other. In fact, we often do not know whether we have to deal with a sympathetically affected eye, or whether the inflammation in the second eye has any connection with the inflammation in the injured eye. Schweigger (*Bericht der Ophthal. Gesellschaft*, 1891, S. 109) recognizes no clinical picture as peculiar to this disease. Until recently he had looked upon the condition when the iris was almost completely adherent posteriorly, and when there was growth and proliferation of connective tissue in the uveal tract with deposits on Descemet's membrane, as characteristic of sympathetic ophthalmia, but he reports two cases where he found identically the same condition as is here described, and where there was no history of injury. Schweigger says the disease may show itself from two to four weeks after the injury. Schmidt-Rimpler makes the earliest limit from four to eight weeks, exceptionally two weeks. Sometimes the disease does not appear for twenty years. Cases have been reported where sympathetic ophthalmia developed in two days (!). It is evident that these different opinions render the factor of time of little or no help to us in establishing a diagnosis. Schirmer has collected statistics which go to show that the diagnosis sympathetic ophthalmia could not stand criticism in twenty-seven cases out of thirty, where the primary trouble was an intra-ocular tumor and where there was no perforation of the eyeball. I would like to lay especial stress upon the uncertainty of establishing a diagnosis when it comes to setting a value upon isolated cases which appear to contradict a whole series of observations. Separate and distinct positive or negative conditions, whether of a clinical or of pathologico-anatomical nature, ought not then to be too sharply emphasized. And this is especially true, 1st, when theories are advanced based upon isolated positive results and regarded thereby as proven; time has already shown us how far in this respect we can go wrong. 2d. In reviewing the operations which are performed nowadays for the treatment or rather the prophylaxis of sympathetic ophthalmia, there are to be met with many observations, and that too from widely different sources, which cast a doubt upon the certainty of almost every operation.

We cannot estimate the value of our method of operation, simply from one case, and just as little can we speak of our method of operation as being the right one. It is clear that we can cut short this migratory inflammation only if we know the track which it follows. There was a time when the problem of the pathogenesis of sympathetic ophthalmia seemed answered by Deutschmann's investigations, but during the past few years his work has met with so many objections in Germany, France, England, and America that a doubt as to the value of his results can no longer be overcome. Two years ago I undertook to verify Deutschmann's work, not doubting that with all the advantages of bacteriology at my disposal I should succeed in proving the parasitic origin of sympathetic ophthalmia. I had at my disposal the extensive material to be found in the clinic of Profs. Schweigger and enjoyed the valuable co-operation of the bacteriologists Pfeiffer and Frosch. To these gentlemen I am under many obligations. My earlier bacteriological investigations were carried on in Koch's Institute, and the others in the laboratory of the University Eye Clinic in Berlin. Time has seen many changes in the views expressed as to the pathogenesis of sympathetic ophthalmia. William Mackenzie in 1844 first described it and suggested three possible ways, any of which the inflammation might follow. 1st. The disease can pass from the blood-vessels of one eye to those of the fellow eye at the point of communication within the brain. 2d. Through the ciliary nerves. 3d. The disease can make its way from the retina of the injured eye along the optic nerve to the chiasm and here set up a condition of irritation, which can communicate itself to the retina of the other eye. Mackenzie thought, however, that the optic nerve was the most usual route followed by the disease. This ended the first period. The second period is represented by the ciliary-nerve theory of Heinrich Müller, which theory prevailed generally up to 1881, and this year marked the beginning of the third period, and is noteworthy as being the year when Snellen, Berlin, and Leber advanced the opinion that sympathetic ophthalmia was of microbic origin. One could also distinguish a fourth period, since observations have multiplied which contradict those of Deutschmann, if only something definite and positive were established. Of this fourth period Schmidt-Rimpler is the foremost representative. He brings forward a modified ciliary-nerve theory and is of the opinion that the disturbances of nutrition and in the circulation brought on by the irritation of the ciliary nerves in the injured eye are alone responsible for the sympathetic inflammation of the other eye. The longer these changes exist and the more extensive they are, so much the more suitable is the soil rendered for the action of the injurious agents whatever they are, whether of chemical or microbic nature.

It is well known that a collective investigation on sympathetic ophthalmia has been made by a committee of the English Ophthalmological Society, Mr. Nettleship being secretary. Two hundred and eleven cases were collected, which appeared in two groups.

1st. The primary symptom being papillitis, usually accompanied by opacities of the vitreous.

2d. Under the picture of uvëitis.

Papillitis occurred in about 10 per cent. of the cases as the first symptom, in half the number soon followed by uvëitis, remaining confined to the optic disc and vitreous in the other half. Doubt about the sympathetic nature of the latter may well be entertained.

Before describing my methods of investigation I shall call attention to a few points. (1) In a large series of investigations it is not sufficient to make sections alone, and even when made by a careful and practised hand, a negative result should not be regarded as absolutely convincing proof. (2) Anaërobic cultures have never been suggested. (3) One has generally experimented with and directed attention to the culture media of the pus organisms without considering that sympathetic ophthalmia seldom makes its appearance after suppuration, and that the disease is practically never seen in connection with panophthalmitis, but, on the contrary, shows itself under the garb of a seroplastic inflammation. It seems expedient then to resort to other culture methods, or if one distrusts the suitability of the present culture media for all kinds of microbes, the surest and simplest way would be the inoculation of the anterior chamber of a rabbit with a piece of the diseased optic nerve. (4) Injuries which lead to sluggish (schleichende) irido-choroiditis and blindness are probably associated with the presence of bacteria. Another question is whether the bacteria have gotten into the optic nerve or its sheaths, and hence it is of greater importance to ascertain whether the organisms are present in the optic nerve of the injured eye than in the eye itself, for it is quite possible to find organisms in the eyeball and none in the optic nerve behind the lamina cribrosa. (5) And after inoculating one eye and causing inflammation in the fellow eye and finding organisms in the latter, it should be ascertained whether this secondary inflammation is not due to a general infection. Hence the importance of examining the blood and other organs.

Cases where a general infection has occurred should be excluded.

The three following cases came under my observation and were examined with every bacteriological precaution.

Case 1.—Wounded in right eye with a knife on June 16, 1890, and when seen had a perforating wound of cornea, wound of lens, and small particles of lens substance in anterior chamber, wound and incarceration of iris, intra-ocular hemorrhage. Light perception. June 25th, sluggish irido-choroiditis. Ten months after this, sympathetic ophthalmia showed itself in the left eye. A few days later resection of the optic nerve was performed and a small piece of nerve was put into a tube for bacteriological examination. I may add that before using the instruments they were rinsed out in pure boiling water so that no sublimate or carbolic acid came in contact with the nerve. Bacteriological examination :

(a) The piece of optic nerve was divided and a portion was put into bouillon.

(b) The other half was put in glycerine agar-agar, and two attenuations were made from this and poured into saucers and kept at blood heat.

(c) A small particle of the nerve was inserted into the anterior chamber of a rabbit.

(d) The remainder was put into absolute alcohol.

The plate cultures and bouillon remained sterile, and six weeks later the media of the rabbit's eye were clear, the piece of optic nerve was still to be seen.

The same systematic examination was gone through with in two other cases where sympathetic ophthalmia had developed, and notwithstanding the most careful bacteriological examinations, according to the various methods, no organisms were found.

Similar results are reported by Nordenson, Ayres, Alt, Berry, Schmidt-Rimpler, Trousseau, Poncet, and Uhthoff. In opposition to all these observers Deutschmann brings forward a record which embodies the bacteriological examination of seventeen eyes which had caused sympathetic ophthalmia, and in every eye but one organisms were found, and as regards this (one) negative result, he says: "It proves that no organisms were found in my sections, and does not prove that there were no organisms anywhere present in the eyeball." In the majority of the cases these micro-organisms were found also in the optic nerve and its sheaths. Wagenmann demonstrated the presence of organisms in two eyes which had given rise to sympathetic ophthalmia. At present then we are justified in this conclusion: Proof does exist that micro-organisms were present in eyes which had given rise to sympathetic ophthalmia. This fact however has never been verified by most investigators, and hence in these latter cases sympathetic ophthalmia occurred without the presence of organisms, and we cannot conclude, therefore, that in those cases where organisms were found that they were the causal agents. Experience teaches us that sometimes a considerable period elapses between the injury and the outbreak of the sympathetic inflammation. In these cases one would suppose that the micro-organisms in the optic nerve of the injured eye would have perished long before the appearance of the disease in the second eye. In order to decide this question I have examined the ends of optic nerves where neurectomy was made for fear of sympathetic disease. My investigations cover fourteen cases, and the period between the injury and the resection of the nerve ranged from three weeks to three months. In every case the operation was resorted to for fear of an outbreak of sympathetic ophthalmia. It was highly probable that septic material entered the eyeball at the time of the injury. Cultures were made on all the varieties of culture media, sometimes pieces were hardened in alcohol, stained after Gram's and Weigert's methods and examined microscopically, and in not a single instance were organisms found in either the optic nerve or its sheaths. I do not mean to say that in all these cases no colonies showed themselves on the plates, for an occasional impurity easily occurs in bacteriological work, but this is recognized by a practised eye. It can be asserted, however, with absolute certainty that in not a single instance did I observe anything which could be said to correspond to what Deutschmann describes and which is supposed to represent the typical case. When he says that one positive result proves more than many negative ones, I take issue with him. The very fact that mistakes and contaminations so easily occur in this kind of work leads one to believe the very opposite of this assertion. One positive result proves nothing in bacteriological work, and it is only when a positive result can be repeatedly obtained that any value can be set upon it. My examinations of resected optic nerves is a continuation and completion of Ohlemann's work. The latter made thirty such examinations, and in every case with a negative result, though especial attention was directed in the various sections to the spaces between the sheaths of the nerve. Randolph examined three eyes which had been enucleated for fear of sympathetic ophthalmia, and in all three the injury resulted from the entrance of a foreign body, and in no case were organisms found, though an exhaustive bacteriological examination was made (Knapp und Schweigger's ARCHIV FÜR AUGENHEILK., Bd. xxi., S. 176). Pflüger made a similar examination in more than a dozen cases, and with a like result (*Bericht der ophthal. Gesellschaft*, 1891, S. 103, Discussion). Deutschmann found organisms in almost every case. Limbourg and Levy found in several eyes a coccus corresponding to one described by Sattler, but experiments with this organism failed to produce sympathetic ophthalmia, and in the majority of eyes examined no organisms were found. All these facts recall to our minds what Koch has declared to be essential for bacterial infection. 1. The organisms ought to be demonstrable in all cases of the disease, and it is self-evident that the organism cannot be the specific one if the disease can occur without it. 2. The organism ought to be found in this disease and in no other. 3. The organism should be found in the tissues in such numbers and under such conditions as to explain the clinical symptoms. 4. It ought to be possible to cultivate such an organism and produce the disease experimentally.

I shall here report the following case of sympathetic irritation which is especially interesting on account of the physiology of the field of vision.

P. Grammann, sailor. Wounded in left eye on May 24, 1891, with a piece of steel. Nothing was removed from the eye. He was obliged to lie in bed with both eyes bound up for twenty days, using leeches and atropia. Immediately after the injury was conscious of a pricking sensation in the region of the forehead, and in ten days later the same sensation was felt in the eye itself. The bandage was removed from the right eye on the twentieth day.

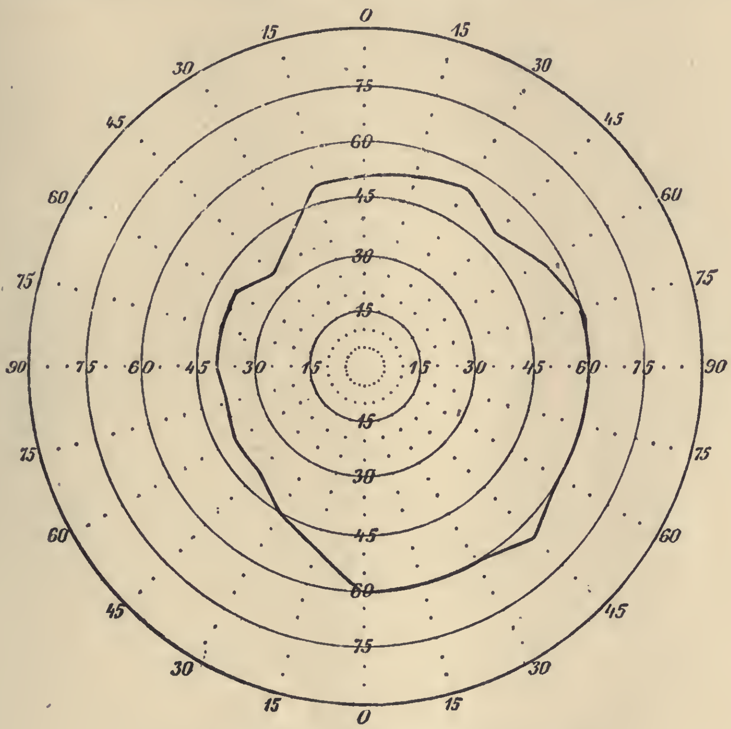

FIG. 1.—Visual field of Right eye with Left open.
S = $\frac{6}{9}$; 0.3 in 20 *cm.*

He could see nothing out of the left eye. At this time the right eye began to water very frequently, and soon became tired and painful and unfit for use. He noticed that when he held his injured eye shut that he saw better with the other eye. *Status:* L. E., unirritable; corneal wound with incarceration of iris. Cataract. V = movements of hand at 1 *m.* Projection uncertain except outwards. R. E., binocularly V = $\frac{6}{9}$, and when left eye was closed,

$V = \frac{6}{6}$, and when the left eye was closed the field of vision in the right eye became wider.

Schweigger has observed this condition several times, but there was always present some vision in the injured eye. Resection of the optic nerve was performed, and portions of the nerve were stained with Weigert's, Gram's, and Löffler's methods, but no organisms were discovered.

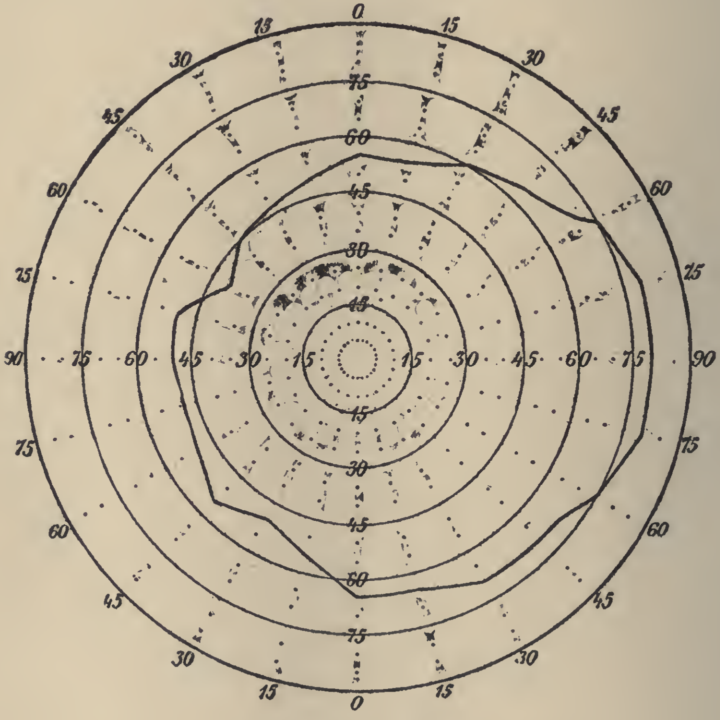

Fig. 2.—Visual field of Right eye with Left closed.

$S = \frac{6}{6}$; 0.3 in 30—20 *cm.*

Kuhnt reports a bacteriological examination of an eye in which sympathetic disease existed, and which had just been enucleated. Inoculations were made from the aqueous, iris, vitreous, and optic nerve upon the different culture media, but with negative results (*Bericht der ophthal. Gesellschaft*, Heidelberg, 1891). Schanz observed a fresh case of sympathetic ophthalmia. After washing out the conjunctival sac of the injured eye, the anterior chamber was opened and the aqueous was drawn up into a pipette, and this with a portion of the iris which was cut off, was inoculated upon various culture media. The result was absolutely negative. As to the experiments on animals. The work of Deutschmann is of course well known. In his experiments he used first the spores of the aspergillus fumigatus, and injected an infusion of this organism into the vitreous or optic nerve of a rabbit, and a few days later he observed optic neuritis and progressive inflammation of the uveal tract. He regards the optic nerve and its sheaths as

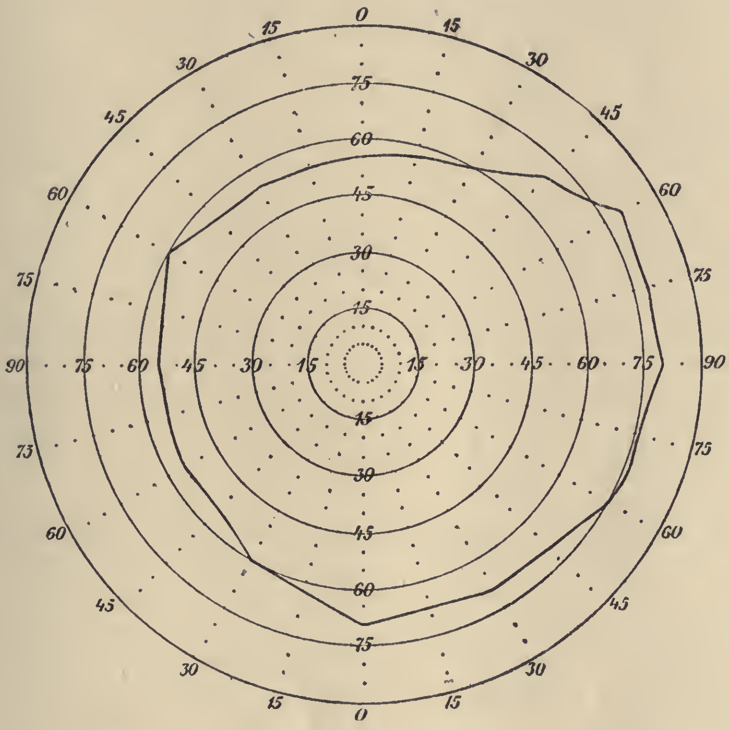

FIG. 3.—Visual field of Right eye after resection of Left.

S = $\frac{6}{6}$; 0.3 in 30—18 *cm.*

the track followed by the organisms. These experiments were repeated with the pus organism and with similar results. Deutschmann's work has been repeated by Alt, Gifford, Mazza, Randolph, Ulrich, Limbourg, Levy, and myself. After injecting a putrid solution into an eye, panophthalmitis was observed by Alt, but no symptom of sympathetic trouble. On saturating a thread in croton oil and drawing it through the optic nerve he observed eight days later neuritis optica in the other eye, which soon disappeared. The injection of an infusion of abrus precatoria (Jequiriti, Bush) was followed in several instances by ophthalmoscopic changes in the other eye, and by the speedy death of the animal (*Amer. Jour. Ophthal.*, July 15, 1884). Gifford was unable to produce any change whatever in the second eye after repeating the experiments of Deutschmann with the pus organism. When he employed the anthrax bacillus, he found in three cases that this organism was present in the second eye (Knapp und Schweigger's ARCHIV FÜR AUGENHEILKUNDE Bd. xvii. S. 14). The great objection to the use of the anthrax bacillus is the rapidity with which general infection follows, and hence one would naturally look for the appearance of the organism in the papilla and uveal tract of the second eye. Randolph has also called attention to this fact. Mazza in experimenting on rabbits and guinea-pigs never observed the migration of staphylococci from one eye to the other, nor did he ever observe any changes with the ophthalmoscope. In those cases where the micrococci were found in the sheaths and trunk of the nerve, the animals had died of meningitis. He concludes that it is impossible to produce sympathetic ophthalmia experimentally with the pus organism (*Bericht des inter. ophthal. Congresses*, 1888, S. 417).

Randolph experimented on eighteen dogs. He used these animals because he thought that they would not be likely to succumb to a general infection. In no case did he detect ophthalmoscopic changes in the fundus of the second eye. The same results he obtained after inoculating eighteen rabbits (These ARCHIVES, vol. xvii., p. 188, and ARCHIV FÜR AUGENHEILK., Bd. xxi, S. 159). Ulrich's experiments on rabbits resulted just as did Randolph's (*Bericht der ophthal. Gesellschaft*, 1891, S. 109). Limbourg and Levy experimented on forty-two animals, mostly rabbits, and their results were all negative (*Archiv für Experimen. Pathologie und Pharmak.*, Bd. xxviii, 1 und 2).

In the few experiments of my own, which I shall add to the above, I have laid especial stress upon this point, namely, whether the organisms wandered into the optic nerve and its sheaths, and whether these same organisms were found elsewhere in the body, in other words, whether a general infection was present. Experiments of this character followed by general infection are to be condemned as evidence in favor of Deutschmann's theory. For the changes in the second eye are to be attributed to the presence of organisms throughout the entire circulation of the body, and not to the fact that the organisms have selected the optic nerve as their route to the other eye. Experiments on rabbits where inoculations are made in other parts of the body often give rise to eye disease. Ed. Meyer was asked to look at a supposed case of sympathetic ophthalmia which had been produced experimentally in a rabbit. He found an almost typical condition in both eyes, but on looking at other rabbits in the same laboratory he observed exactly the same symptoms, although these latter had been used for an entirely different character of experiments, where the inoculations had been made in parts of the body remote from the eye (*Bericht der oph. Gesellschaft*, 1891, S. 104). We know that sympathetic ophthalmia in man is never attended with general infection. And under this head I may mention the case described by Gayet, who claims to have produced sympathetic ophthalmia by introducing into the anterior chamber of a rabbit a piece of a tumor taken from the lachrymal sac. The inoculated eye became blind, and fourteen days later the other eye inflamed and took on a violent keratitis. Such a picture does not correspond to that of sympathetic ophthalmia, and Gayet's assumption that this was sympathetic ophthalmia is open to grave doubt. Such forms of keratitis are often the expressions of a general disease, and unless it could be clearly demonstrated that the rabbit was otherwise sound it can not be regarded as an undoubted case of sympathetic ophthalmia.

Injected a putrid solution into the vitreous of three rabbits and panophthalmitis resulted at once with rupture of the ball. No changes were visible in the second eye. A few weeks later the ball was enucleated and, together with a small portion of the nerve, was examined for organisms. None were found and this was to be expected, for were pus cocci in the habit of migrating into the optic nerve and its sheaths, retrobulbar abscesses or inflammations would often occur in panophthalmitis. The aspergillus fumigatus was injected into the vitreous of four rabbits. On the first day the changes described by Leber were observed. In two cases I observed a slight haziness of the fundus with tortuosity of the vessels and redness of the papilla, but these appearances were gone in two or three days. These were the changes already described by Randolph, and which the latter has ascribed not to the presence of organisms but to a reflex overfilling of the vessels caused by the inflammation going on in the inoculated eye. I injected an emulsion of the staphylococcus pyog. aureus into the right eye of seven rabbits, and after a certain length of time an examination was made of the end of the optic nerve of the right eye and also of the left eye. The blood from several of the organs was also examined. One of the rabbits died of meningitis, two others wasted away and four lived. An examination in the first three cases revealed inflammatory changes in the second eye, and organisms were found in the end of the optic nerve and also in other organs of the body. Of the other four rabbits which lived, one showed slight changes in the second eye, but no organisms were found in any of these cases. The fact could not be established that a direct migration of the organisms through the channel of the optic nerve and its sheaths had occurred. And, furthermore, organisms were found in the second eye in those cases only in which organisms were present in other organs of the body, and thus had reached the second eye through the general circulation. These experiments failed then to produce genuine sympathetic ophthalmia without a general infection.

And when I take into consideration all my own investigations and the various literature upon the subject, I have come to the conclusion that Deutschmann's migration theory cannot be regarded as proven, and that it is not proven till sympathetic ophthalmia can be produced experimentally by other investigators and that too over and over again, and until organisms can be demonstrated in the second eye without the co-existence of general infection. And furthermore, it is my opinion that the present methods of bacteriological examination have proven the absence of organisms, in cases where sympathetic disease has broken out and where the eyeball and optic nerves were subjected to an examination.

In looking about in the medical world we see much that is unfinished and unknown, and especially in those things pertaining to bacteriology. Many processes no doubt of parasitic origin remain still unproven. The migration theory is still an hypothesis, just as is the ciliary nerve theory. It has recently been suggested by several ophthalmologists and bacteriologists that possibly the metabolic products of the organisms and not the organisms themselves get into the lymph streams, and passing over to the other eye set up inflammation. Rosenmeyer (X. *Inter. Med. Congress*, Bd. IV., S. 127) and Gorecki (*Société d' Ophtal. de Paris*, Séance du 7 Avril, 1891) have both suggested this solution of the problem. Limbourg and Levy concluded their experiments with the following: Sympathetic ophthalmia ought to be regarded as a lymphangitis, which can be distinguished from lymphangitis in other parts of the body by its complicated anatomical and physiological characteristics. In lymphangitis of the extremities, few cases are to be found as a general thing, and in these cases the cause of the suppuration is undoubtedly of a chemical nature, the toxalbumen. This may be the case with sympathetic ophthalmia, but there exists a great clinical difference between the two. We have febrile manifestations as soon as toxalbumen gets into the lymph or blood currents, and we have no such symptoms in sympathetic ophthalmia, though Pflüger (*Bericht der ophth. Gesellschaft zu Heidelberg*, 1892, Discussion, S. 24) reports a case of sympathetic ophthalmia with violent headache and fever. This isolated case, however, cannot be regarded as weighty evidence. These clinical symptoms are valueless unless observed in many cases. I made some experiments with a sterilized pyocaneus bouillon culture, which Dr. Schimmelbusch of Berlin kindly placed at my disposal. After injecting moderately large doses into the vitreous of rabbits, the latter died very soon with violent febrile manifestations. Small doses injected into the vitreous brought on fever, suppuration of the vitreous, and a sluggish iridochoroiditis. When the fever abated the inflammatory symptoms disappeared and the eyeballs shrunk up, though the animals remained alive. Of course these few experiments prove nothing. But the absence of fever in a case of sympathetic ophthalmia does not permit us to assume that the metabolic products of the organisms in the lymph or blood currents are carried over directly from one eye to the other, and so cause sympathetic inflammation. Or can such a process occur gradually without any marked elevation of temperature? On anatomo-physiological grounds I cannot reconcile myself with any such theory.

In conclusion I call attention to the work of Schirmer which appeared in the last number of *von Graefe's Archiv*, year 1892. After following in detail, in a long series of experiments, the work of Deutschmann, and after examining, both histologically and bacteriologically, eyes which had given rise to sympathetic ophthalmia, he could find nothing to justify Deutschmann's conclusions. Schirmer, like myself, is inclined to believe in the parasitic origin of sympathetic ophthalmia. I regard rabbits as absolutely useless in this class of experiments, but even if we succeed in obtaining a specimen for examination in the case of the disease in man, the present status of bacteriology will give us no result. *Multum restat adhuc operis, multumque restabit.*

BILATERAL HEMIANOPSIA, WITH AUTOPSY.

By Prof. SCHMIDT-RIMPLER, of Goettingen.

Translated by Dr. J. A. Spalding, Portland, Me.

(*With two figures in the text.*)

FOERSTER,[1] Schweigger,[2] Groenouw,[3] and Vorster[4] have each observed and described a case of this nature, but so far as I can discover none with an autopsy has ever been published. The latter I am now enabled to offer for the first time, though the preliminary observation first appeared in the second edition of my text-book on diseases of the eye.

Georg H., æt. fifty-one, was hit on the head in January, 1873, with a heavy stone, falling from a distance of fifteen feet above him. He became unconscious at once, and remained so for several hours. The scalp wound was sutured, though no bone is reported to have been removed, and in five days he was at work once more. He remained fairly well on the whole till 1875, with occasional pain in the head and vertigo, lasting for a few minutes only. At New Year's Day he first perceived on getting up in the night a weakness in his right leg, and on returning to bed he became unconscious and remained so for twelve hours. In March he began work again despite the slight hemiplegia, but often had to be taken home partly unconscious. A second attack came on at Easter, as he was pulling on his stockings. He also became deaf in his right ear, and his attention was called to a defect in the right field of vision, slight at first, then increasing, and in a few days remaining stationary. He was taken into the hospital in May, with pain in the right arm and leg, and the visual fields affected as figured in the accompanying sketches.

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[1] *Graefe's Archiv*, Band xxxvi., p. 94.
[2] These ARCHIVES, vol. xxii.
[3] *Archiv für Psych. und Nervenkrankheiten*, Band xxiii., p. 339.
[4] *Allgemeine Zeitschrift für Psychiatrie*, Band xlix., 227.

There was nothing pathological in the ophthalmoscopic picture of the fundus of either eye, and vision in each eye was normal.

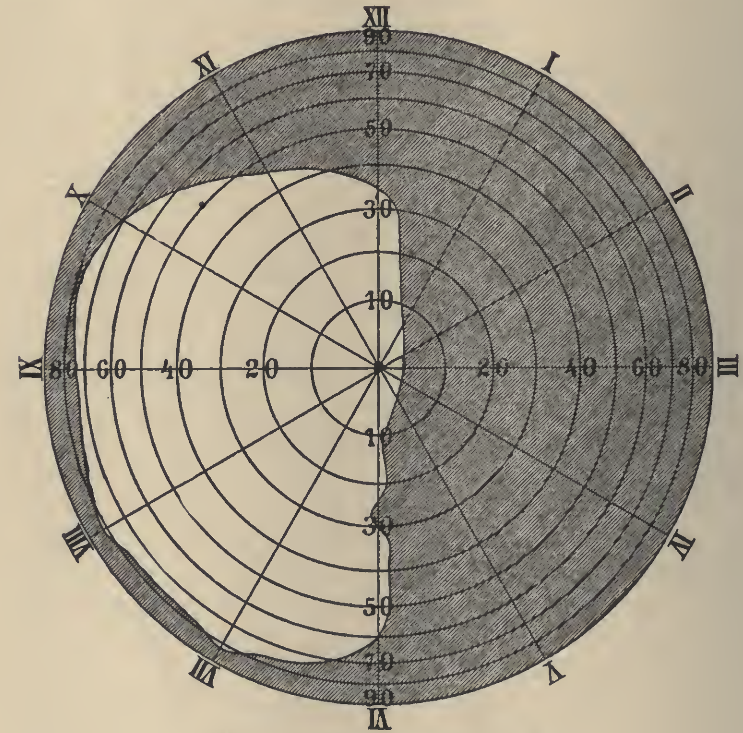

FIG. 1.—Left Eye.

As time proceeded the fields remained about the same, but the deafness in the right ear decreased, as well as the right hemiplegia. The patient's condition remained about the same for many months, and he was again at work in 1876, when in December he suffered more than before from headache, and on the 13th of that month a distinct diminution of the sight, which he attributed to exposure to dampness. A week later he had a desire to put out the light on going to bed, but found that he could no longer see it, though he had seen it fairly well on the day before. Slight chills from time to time.

The condition on December 21st, when he came into the clinique once more was as follows: Body well nourished. On the right temporal bone a very small hard cicatrix. Mind clear, but answers to questions are slowly given. Memory poor; confuses right and left. The headache and vertigo have ceased. Hearing for watch: Right, 18 inches; Left, 2 inches. Tuning-fork and bone-perception tests are confusing to the patient, and his answers incorrect. No facial paralysis, though the tongue when outstretched points a little to the left. The patient confesses that he finds it harder to utter words than of old, but there is no apparent difficulty in speaking. Movements of the right arm and

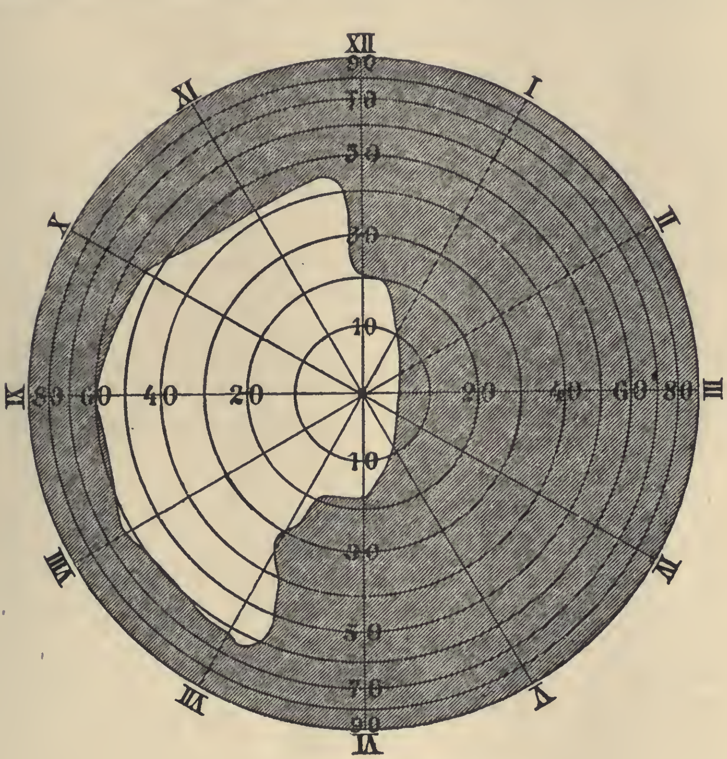

FIG. 2.—Right Eye.

grasp of the right hand are less forcible than those of the left. The sensibility on the inferior and dorsal side of the right hand is less than that on the left hand, so that the patient, for instance, cannot button his waistcoat so well with his right hand as with his left. Sensibility is also slighter in the right foot, than in the left.

The eyes are normal in appearance. The pupils react about alike, though the left is slightly more rapid than the right. Vision is reduced to the distinction between a bright flame and a low flame, and only in a small portion of the field. Ophthalmoscopically there is nothing abnormal.

Vision improved rapidly in the following days, so that at first the patient could count fingers in a small portion of the field and close to the eyes, and later, early in January, 1877, he could by exerting himself see in a small part of the field $\frac{12}{20}$ of the test letters. Colors were correctly recognized. By the end of January central vision was practically normal, but without any enlargement of the field. The condition remained the same till March or April, when vision again began to fail, and the functions to become impaired; but up to his death, August 13, 1877, he could see to the same extent as before, though not quite so well as in April.

The autopsy revealed: diffuse hematoma, cicatricial contraction in the region of the injury; foci of softening in the border between the gray and white substances; in the right temporal lobe an apoplectic cyst, and in the right cerebellar hemisphere apoplectic cysts. Hypertrophy of the heart on both sides. Connective-tissue retraction of the apices of the lungs on both sides; infarction of the spleen, and granulation of the kidneys.

Careful investigation of the calvarium revealed a firm adhesion of the dura mater to the bone, so that on both sides it was impossible to separate them without a considerable injury to the parts. For that reason the spinal cord was freed from below, and the brain, a portion of the skull, and the cord removed all together. A yellowish-green mass came into view on removal of the brain. At the fissure of Rolando was a firm adhesion between the dura and arachnoid about 2 *cm* in length. Between the arachnoid and dura more of the yellowish-green substance containing numerous hemorrhagic foci as large over as a copper cent, which was easily removed from the dura. There were no traces of adhesion between the arachnoid and dura of the cerebellum.

The brain itself is small, and the right hemisphere, one or two convolutions behind the falx, is depressed over a space the size of a half dollar, yellowish in tinge and rather soft to the touch: There is also a cicatricial depression nearly 1 *cm* deep, 2.2 *cm* long, and 3.5 *cm* across, near the left posterior central convolution. The depression is of a decidedly yellowish tinge in front. The pia over the entire region is of a milky tinge. Looked at from in front, the right temporal lobe looks fuller and broader than the left. The brain as a whole, omitting the cyst above mentioned, feels resistent, and a trifle more so on the left side than the right. The lateral ventricles are empty, though over the corpus callosum is a fresh blood clot which extends into the left lateral ventricle. The left corpora quadrigemina are flatter than the right. The posterior portion of the right occipital lobe between the gray and white substance contains some sharply defined foci with soft greasy contents. The optic thalami vary, the gray and white substance in the left thalamus being hardly distinguishable apart, and with small yellow dots, whilst in the right thalamus white and gray substance are sharply defined, and the gray is even darker than in the left thalamus. Corpora quadrigemina unaltered. The upper side of the right cerebral hemisphere contains a cicatricial depression 4–5 *cm* long, 1 *cm* wide, and 2–3 *mm* deep. A cross section corresponding to the depression reveals a yellow deposit. The fourth ventricle is rather broad, and the striæ acusticæ of the right side more distinct than those in the left. Both optic nerves are flatter than normal, and white on section. The left tractus opticus in front is less round and flatter than the right, and at the chiasm is a distinct constriction. The arachnoidal vessels are much injected. Various sections of the cord showed nothing abnormal.

The optic nerves were submitted to a minute microscopic examination, without, however, revealing anything abnormal, at least no atrophy.

REMARKS.

The hemianopsia homonyma dextra in this case was preceded by headache and paresis of the right extremities with clonic spasms. A year later, after a short prelude of subjectively observed contraction of the field, absolute total blindness suddenly ensued. A small central visual field was gradually restored, but slowly it became reduced to a minimum. The autopsy revealed as the cause of the first right-sided hemianopsia a hæmatoma of the dura mater. The right paresis must be regarded as a sequence of the extensive cicatricial contraction in the posterior central convolution. The yellowish bean-sized foci of cheesy matter lying in the region between the gray and white substances in the posterior portion of the right posterior lobe may explain the later loss of the left visual field. The macroscopic condition of the left thalamus and left optic tract is to be regarded as of secondary degeneration, but the optic nerves in their intraorbital course were not affected.

Foerster's case began with a right hemianopsia and with no cerebral symptoms unless a slight headache is so to be considered. But the line of demarcation was not quite perpendicular, and there were defects both above and below the horizontal line, as well as in the region of the macula. Vision was at first $\frac{1}{3}$, later it became normal, and then was totally lost in a very few days. Later still, however, a small portion of the field was discovered with vision of $\frac{1}{3}$. Color sense abolished. Worthy of note was the loss of the recollection of locality: even after remaining for a long time in his own chamber, the patient never could tell where anything lay, nor could he move about half as well as the totally blind, who often learn an astonishing amount of information of their surroundings.

Schweigger's case exhibited a sudden left hemianopsia without any central disturbances. A year later the right field was lost, only a minute central portion remaining intact to the last. Movements of the hand were, however, at times recognized all over the otherwise defective field. There was no loss of the sense of locality.

Groenouw saw left hemiplegia in January in a man of fifty-eight, followed by left hemianopsia in April. Ten months later an apoplectic attack. Remarkable decrease in orientation. Field, ten days later, very narrow in all directions, but vision = 1. In another month an improvement in the field, but total loss in the right inferior quadrants. Colors visible, centrally.

Vorster saw a case of apoplexy in a man of forty-nine, the second of the sort, the first occurring four years previously with loss of sensibility on the right half of the body and indefinable sensations of loss of sight. Later still, a third apoplectic stroke, with loss of consciousness, left facial paralysis, paralysis of the extremities, and total loss of sight. The patient could not even see the sun. Eight days later, return of vision, so as to see adjacent objects, on the right side only. Four weeks later, hallucinations, and incapacity for finding his way about in familiar places. Vision, Sn 9 at 50 *cm.* Total loss of the left half of field left, and contraction in the right. Nothing abnormal with the ophthalmoscope. Four months later, Vision, Right, $\frac{1}{3}$; Left, $\frac{1}{4}$. Color sense gradually returned. Both halves of the field defective, with exception of a zone surrounding the point of fixation, 10° in extent. Line of demarcation perpendicular. Right field, loss of color perception, except near fixation point ; peripheral contraction.

Foerster has drawn from his case certain conclusions which deserve further discussion. The preservation of a small central field despite the loss of all the rest induced him to offer the hypothesis that the small portion in the occipital lobe which serves for the most acute perception, the direct vision, is nourished by abundant anastomoses of two or more vessels. If now the main trunk which nourishes the occipital lobe is thrombosed, and the cortex over a larger extent is consequently cut off from the supply of material, the region of most acute vision might obtain nourishment from the second vessel, and in that way maintain its functions intact. In this way we might also explain in hemianopsia the frequent deviation of the line of demarcation toward the defective side. Foerster further believes that he can utilize this condition in the diagnosis of the location of the focus which causes the hemianopsia, in that in cases in which the line of demarcation passes directly through the point of fixation, the focus does not lie in the cortex but in the path of the tractus itself. Up to this time, as is well known, the frequent affection of the field in the region of the yellow spot had been explained by the theory that the yellow-spot region is supplied by both tractus optici. Foerster thinks that this is an entirely erroneous idea, because his patient after the second attack ought to have become totally blind. If, on the contrary, we ascribe to that part of the cortex which produces macular vision a greater resistance, we easily see why macular vision remains to the last. Furthermore, in my case, and in that of Vorster, total blindness was present. I should therefore suppose that, in either the one or the other of the previously reported cases of bilateral hemianopsia, there must have been in the very beginning of the loss of the visual field a rapid but transitory loss of sight. From all this we see that there is no compulsory reason to abandon the idea that the macular region in a certain series of patients has a bilateral nourishment from the blood-vessels. It is also plain that the cases reported by Wilbrand,[1] with autopsies, confirm such a view. And we further see from these contributions that Foerster's hypothesis of being able to diagnosticate the locality of the lesion from the course of the line of demarcation is in direct opposition to these facts. Other facts in support of my views are these. Whilst the perimetric measurements in hemianopsia show that the defect in the field does not always correspond with the perpendicular, but that the intact field often passes the perpendicular, or inversely the defect crosses over into the percipient halves, the defect never passes over into the seeing halves at the point of fixation. Either the line of demarcation passes directly through it, or it lies in those halves of the eye that still perceive. These variations in the line of demarcation are in my opinion the outcome of individual variations in the expansion of the retinal fibres of the tractus opticus. All in all, one half of the retina is supplied by one tractus, the other by the other tractus, though the supply need not mathematically correspond to the precise line of demarcation. This, too, seems quite satisfactory, for if nature with her division of the nerve fibres had made every arrangement for perimetrical measurement of the visual field, the slightest radial deviation of the eye would disturb this beautiful coincidence, and be followed by a deviation of the halves of the visual field from the perimetrical perpendicular. If, now, experience teaches us that in hemianopsias the point of fixation always lies in the halves of the field that see, we must come to the conclusion that it is supplied by both tractus, for so only can we explain that it is never drawn into the defect in contra-distinction to those portions lying above or below it in perpendicular meridians of the retina, where the individual variations of the division of the tractus are so clearly to be seen. The physiological importance of this region, as well as the anatomical size of the macular nerve-fibre-bundle, give further support to the theory of double supply.

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[1] *Die hemianopischen Gesichtsfeld-Formen*, 1890, p. 109.

Foerster's hypothesis that the cortical region which corresponds to the macula is particularly capable of resistance, finds much support in all the cases that have so far been reported. But whether this depends upon a peculiar arrangement of the vessels or upon other foundations must still remain an unanswered question. My case does not seem to argue directly in favor of any particular role having been played by the subdivision of the blood-vessels. It is remarkable to see how, in opposition to this great resistance-capacity of the macular cortical regions, the macular fibres running into the optic nerve are chiefly exposed to disease and disturbances of function, as is demonstrated by the frequent observations of central scotomata.

Whilst Foerster's patient permanently lost the power of perceiving colors, the faculty returned in the cases reported by Groenouw, Vorster, and myself.

The decrease in the capacity for orientation which Foerster has so closely studied is, I regret to say, not mentioned in my case, for I watched my patient before Foerster had called attention to this peculiarity in similar cases of hemianopsia. Groenouw observed the defect in his patient, and Vorster remarks upon the difficulty that his patient had in finding his way about, though in this case we must not forget the patient's loss of mental equilibrium. Schweigger, on the contrary, could not see that his patient suffered from any such disturbance. Hence it is plain that further observations may be needed before we can assert with Foerster that such is a common symptom of hemianopsia.

The condition of the pupil reflex corresponds to the anatomical seat of the lesion as beyond the reflex curve. In hemianopsic visual-field defects, the cause of which lay this side of the curve, I have often seen a sluggish reaction on illumination of the corresponding halves of the retina. Hence there need not necessarily be total absence of the reaction simply because some light also falls upon the parts that still perform their function. The best method of testing is to throw with the ophthalmoscope small images of the flame, now upon one and then upon the other half of the retina, whilst, in the interval, the pupillary reaction is watched by a second observer. And yet in the diagnostic valuation of this symptom we must bear in mind, that even in a paralysis lying beyond the reflex curve, atrophy and subsequent loss of conduction from secondary degeneration may affect the reflex fibres additionally.

THE POSITION OF THE SOURCE OF LIGHT AND THE OBSERVER IN SKIASCOPY OR THE SHADOW TEST.

By EDWARD JACKSON, A.M., M.D.,

PROFESSOR OF DISEASES OF THE EYE IN THE PHILADELPHIA POLYCLINIC, SURGEON TO WILLS EYE HOSPITAL.

IN skiascopy, we seek to measure the amount of myopia, either natural or produced by lenses; or to ascertain what lens is required to produce a certain amount of myopia. The amount of myopia is ascertained, the point for which the eye is focused is determined by the apparent movements of light in the pupil, which indicate whether this point is behind the observer's eye or in front of it. The apparent movements of light and shadow across the pupil are produced by the real movement of an area of light upon the pigment layer of the retina or choroid.

This light area upon the fundus of the eye is the more or less perfect image of the source of light employed for the test. In order that its movements may be most definite and readily discernible, it should be as small and as brilliant as possible, conditions attained when the image of the source of light is most perfect—that is, when the light from the lamp flame employed is most perfectly focused upon the retina.

The lamp flame used we may call the *original source* of light. The mirror reflecting the rays from this source gives rise to an image of it, which may be called the *immediate source* of light, because the rays enter the eye as from a source of light in the position of this image.

With the plane mirror, the image is a virtual one, situated behind the mirror as far as the original source of light is in front of it. With the concave mirror, the immediate source of light is a real image, formed in front of the mirror at the focus conjugate to the position of the lamp flame or original source.

It is the differing movements of this immediate source of light that give the opposite movements of the light area in the pupil, according as the plane or the concave mirror is employed.

Now the problem as to the position of the source of light in practising skiascopy is simply the problem of bringing the immediate source of light as near as possible to the point of reversal of the eye examined—that is, to the point for which the eye is focused; since from that point the most perfectly focused image of the source of light will be formed on the retina.

When the point of reversal is determined—when the final and most accurate measurement by skiascopy is made—the observer's eye and the mirror held in front of it will closely approximate the point of reversal; or the point of reversal will, by the lenses used, be made to closely approximate the position chosen for the observer's eye. It becomes necessary, therefore, when the final or accurate application of the test is to be made, to have the immediate source of light (that is the image of the original source formed by the mirror) as close as possible to the observer's eye.

With a plane mirror, the *immediate* source of light is as far behind the mirror as the *original* source was in front of it. The closer the original source is brought to the mirror, the closer will the immediate source be brought to its desired position. Hence, *with the plane mirror, the lamp flame should be brought as close to the mirror as possible.*

With the concave mirror, the immediate source of light being an image of the lamp flame, conjugate to the flame itself, it will retreat from the mirror as the lamp flame is brought towards it; and will approach the mirror as the lamp flame is carried farther away, until when the lamp flame reaches an infinite distance, the image of it, which is the immediate source of light, will reach the principal focus of the mirror. Nearer than this it cannot be brought. *With the concave mirror*, therefore, *the immediate source of light is brought to its most desirable position by carrying the original source as far behind the patient as possible.*

The position of the original source of light then should be for the plane mirror as near it as possible, and for the concave mirror as far as possible behind the patient. The necessity for interrupting the reflection of the mirror from an area at its centre to give the sight hole, through which the movements of light are to be watched, limits the possible accuracy of the test; so that it is as accurate as practicable if the light is within a few inches of the plane mirror, or at a distance of 2 metres or more from the concave mirror.

The approximation of the immediate source of light to the point of reversal will also depend upon the position of the observer's eye. With the plane mirror, the immediate source being back of the mirror, will be nearest to the point of reversal when the observer's eye is in front of that point; that is, when he follows the direct image of the eye he is looking at and gets the movement of light in the pupil with the movement of light on the face. Therefore, *the greatest distance at which the light in the pupil moves with the light on the face will be the closest approach to accuracy with the plane mirror.*

On the other hand, with the concave mirror the immediate source of light being in front of it, will be nearest the point of reversal when the observer's eye is beyond the point of reversal, where he obtains the inverted image of the fundus looked at and where, also, the light in the pupil moves with the light on the face. Therefore, *with the concave mirror, the closest approach to accuracy will be made in the determination of the nearest point to the patient's eye that the light in the pupil moves with the light on the face.* Such are the conditions as to the position of the light and of the observer for simple hyperopia and myopia.

ASTIGMATISM.

In astigmatism we have to consider two points of reversal instead of one. The retinal light area presents at either of these points of reversal the appearance of a band running in the direction of the meridian, whose point of reversal is at the observer's eye. If, in the direction of this band, it is desired to determine just where the point of reversal is, the immediate source of light must be brought as near as possible to the point of reversal for this meridian; that is, we must arrange the position of the light and of the observer just as in simple hyperopia and myopia.

If, however, it is desired to bring out the band with the greatest distinctness, so as to determine if such an appearance of the retinal light area is really present, or to fix its direction with the greatest accuracy, the arrangement of the light must be different. The band, in order to be seen most distinctly as a band, demands that the light shall be sharply focused from side to side: while it is indifferent as to how it is focused in the direction of the band. The focusing at right angles to the band depends upon the effect of the cornea at right angles to it, upon the refraction of the cornea in its other principal meridian. To get the most perfect focussing in that other principal meridian, the source of light must be made to correspond with its point of reversal. Hence, *to bring out most distinctly the characteristic band-like appearance of the light in the pupil, the observer must place his eye at the point of reversal for the meridian in which he wishes to obtain the band, and place the immediate source of light at the point of reversal for the other principal meridian.*

Suppose it is desired to determine the direction of the principal meridian of greatest myopia, commonly the vertical meridian. The band in this direction will be seen at its point of reversal, which is, of the two, the point of reversal closer to the eye. Here, then, the surgeon must place his own eye. Using, then, the plane mirror and then moving the original source of light as far from the mirror as the distance between the two points of reversal, the band-like appearance in the light will come out with the greatest distinctness. It will be clearly visible even though the astigmatism be less than 1 D.

On the other hand, if he desires to bring out the band which runs in the direction of the meridian of least myopia, he must place his eye at the point of reversal of that meridian, the point of reversal which is, of the two, the farther from the eye.

Now, to secure the placing of the immediate source of light at the other point of reversal, which is between the observer and the eye he is looking at, it will be necessary to employ the concave mirror, which gives the immediate source of light in front of it. And the distance of the image in front of the mirror is to be varied by changing the distance of the original source of light from the mirror.

For instance: Suppose the patient to be in the vertical meridian, myopic 2 D, and in the horizontal meridian, myopic 1 D. To get the vertical band of light in the pupil, the surgeon places his eye one half metre from the patient (at the nearer point of reversal). The other point of reversal, where the immediate source is to be placed, being one metre from the observed eye, will then be one half metre back of the mirror; and the original source of light will, therefore, need to be placed one half metre in front of the mirror.

When these conditions are complied with, there will be observed a very distinct vertical band moving from side to side with the light on the face, but which cannot be observed to move in the vertical direction.

To study the horizontal band the surgeon must come to the point of reversal for the horizontal meridian one metre from the eye, and to make it most decided will require his immediate source of light one half metre in front of him, and one half metre from the patient's eye. To do this he must use a concave mirror. Suppose it to have a focal distance of 25 cm; then, to bring the immediate source of light 50 cm from the mirror, the original source must be brought up to the same distance from the mirror. The conditions, then, for studying the direction of this band are: the observer one metre from the eye with a concave mirror of 25 cm focus, and the light 50 cm away from it. And under these conditions, with a single dioptrie of astigmatism, the band will be very distinct.

In practice, it is only necessary to fix the direction of one principal meridian; and make the measurements of the refraction in both of them. This can be done with either the plane or the concave mirror. With the plane mirror the meridian of greatest myopia or least hyperopia will be fixed, with the concave mirror the other principal meridian; each showing the band which moves with the light on the face.

Probably all who have employed skiascopy to any considerable extent have been puzzled by the differences of the distinctness of the band produced in astigmatism at different times or in different cases. These relations of the positions of the source of light and the observer's eye to the observed eye explain such variations for the greater number of cases. Other factors not without influence are the aberration of the eye and the amount and kind of irregular astigmatism; also the size and brilliancy of the source of light employed, but unquestionably the principal source is the failure to observe the conditions of success above indicated.

Skiascopy has too often been attempted by the guidance of certain rule-of-thumb directions, without any clear understanding of its optical basis; and the confusing results from such attempts have more than anything else retarded its progress towards universal employment.

SOME REMARKS UPON RETINOSCOPY AS A METHOD OF DETERMINING THE REFRACTION OF THE NUCLEUS OF THE LENS.

By JOHN DUNN, M.D., Richmond, Va.

FOR the past three years I have been using retinoscopy as a method for determining the refractive condition of the eyes, and, generally, I have found it altogether reliable both in regard to the degree of myopia and hyperopia, and as a method of determining the axis of astigmatism and the degree to within ¼ D. There have been two classes of cases where I have been disappointed in the accuracy of this valuable method, and a few remarks in regard to one of these cases may not be out of place. Reference is made to those cases where in applying the shadow test we get a confusion of shadows, so that after we have obtained the "shadow in all directions" that should mark the turning-point, we find that it requires a whole additional dioptrie or perhaps one and a half to reverse the shadow. At times we even get from the same half of the eye two shadows moving in different directions at the same time, or a double shadow of different intensities. And we find that, when we finally reverse the shadow as a whole and adjust before the eye of the patient the glass we expect to suit, the glass chosen does not give the best vision for distance; that much clearer vision can be obtained by the addition of a weak plus or minus glass, or of a cylinder. These cases occur frequently enough to offer a distinct objection to what is, when properly understood, the most valuable of all the methods of determining the refraction of the eye. The explanation of this "confusion of shadows" lies in the fact that in these cases *the refraction of the nucleus of the lens is different from that of the outer part of the lens.* So far as I know there is no means other than retinoscopy by which can be measured the refraction of the nucleus of the lens, when this nucleus is of such a density as to differ in its refractive power from the lens as a whole. By means of retinoscopy this refraction can be determined to $\frac{1}{4}$ D. Let us take the following case as an example:

Mr. Mann, aged thirty-one, pupil fully dilated by homatropia. Holding a + 1 D sph. before the right eye and revolving our mirror for the vertical meridians, watching the edge of the iris, we see that no definite shadow movement is to be obtained, either from the inner or the outer side of the pupil. The same is found to be the case for the horizontal meridians as determined by revolving our mirror up and down. Holding before the eye a + $1\frac{1}{4}$ D sph. we find that the movement of the shadow from the iris edge is with the movement of the mirror; a + $\frac{3}{4}$ D sph. furnishes a shadow moving against the mirror. Thus a + 1 D furnishes "shadows for all directions alike." The patient's refraction should be normal. He should read our Snellen $\frac{18}{15}$. Ask him to do it and we find that he can read only $\frac{18}{40}$. What is the matter? Retinoscopy is not at fault. Let us look a little more closely at our shadows. Holding a + 1 D sph. before the right eye and revolving our mirror for the vertical meridian of the inner half of the eye, what do we see? While it is true that the pupillary edge furnishes no definite shadow, if we look closely we see a second shadow, which makes its appearance about half way from the centre of the lens to the pupillary margin, and this shadow moves *against* the movement of the mirror. Neglecting now the pupillary edge shadow we turn our attention to this inner shadow. It moves *against* for + $1\frac{1}{4}$ D; *against* for + $1\frac{1}{2}$ D; its movement cannot be made out for + $1\frac{3}{4}$ D; for + 2 D its movement is with the movement of the mirror. Let us now see what it does for the horizontal meridians; this inner shadow moves *against* for + 1 D sph.; is indeterminate for a + $1\frac{1}{4}$ D; moves *with* for + $1\frac{1}{2}$ D. Thus + $\frac{3}{4}$ D is the lens for the vertical meridian; + $\frac{1}{4}$ D for the horizontal meridian—*of the nucleus*, and with a + $\frac{1}{4}$ D sph. c + $\frac{1}{2}$ D cyl. ax. 90° Mr. Mann reads $\frac{18}{15}$ with ease.

When we have a $+ 1\frac{1}{2}$ D sph. before the eye, if we watch both shadows for the inner half of the eye at once, and the same applies for the outer half, we find that the *cortical* shadow moves *with* the mirror while the *nuclear* shadow moves *against* it. Thus we have in the same half of the eye at the same time two shadows moving in opposite directions. The movements of both of these shadows can be seen, inasmuch as there is at the beginning of the movement a clear space between the iris edge and the nucleus. Let us take O.S.: a $+ 1$ D sph. held before the eye gives from the pupillary edge an indeterminate shadow when the mirror is revolved for either the vertical or horizontal meridians. We should expect the patient to read $\frac{18}{15}$ Snellen with ease. He read only $\frac{18}{30}$. Again we look more closely and we find when we move our mirror for the vertical meridians that while the pupillary edge furnishes no determinate shadow, there is a shadow moving against the movement of the mirror, which shadow proceeds from a distance half way from the centre of the lens to the pupillary edge. Now, watching this inner shadow, we find that it moves *against* the mirror for a $+ 1$ D, $+ 1\frac{1}{4}$, D, and $+ 1\frac{1}{2}$ D; is indeterminate for a $+ 1\frac{3}{4}$ D sph.; and moves with the mirror for a $+ 2$ D sph. For the horizontal meridians this inner shadow is indeterminate for a $+ 1$ D sph. and moves with the mirror for a $+ 1\frac{1}{4}$ D. Consequently we should expect a $+ \frac{3}{4}$ D cyl. ax. 90° to give $V = \frac{18}{15}$, which it does. When we are holding a $+ 2$ D sph. before the eye, and revolving the mirror for the vertical meridian, we see two shadows moving in the same half of the eye at the same time in the same direction; these shadows have, however, different intensities, the one proceeding from the pupillary edge being denser than the one proceeding from the nuclear edge.. Thus in the case of Mr. M., the refraction of eyes beyond the nucleus is normal; while for the nucleus the refraction O.D. is $+ \frac{1}{4}$ D sph. c $+ \frac{1}{2}$ D cyl. ax. 90° and O.S. is $+ \frac{3}{4}$ D cyl. ax. 90°.

Or, again, the case of Mrs. C., aged forty, O.D., $V = \frac{18}{40} - \frac{18}{30}$. O.S., $V = \frac{18}{40} - \frac{18}{30}$! Homatropia. Complete dilatation of the pupil. *O.D.* + 1 D held before the eye; revolving our mirror for *the horizontal meridians* we find that the shadow from the pupillary edge is with the movement of the mirror, we consequently should expect to find a minus glass necessary for this meridian. We change + 1 D to + $\frac{3}{4}$ D and we feel that the pupillary edge furnishes for the horizontal meridians no determinate shadows; while + $\frac{1}{2}$ D gives a shadow against. Let us now test the vertical meridians for a + 1 D sph. The pupillary edge shadow is against the movement of the mirror; so for a + 1 $\frac{1}{4}$ D; + 1$\frac{1}{2}$ D; + 1$\frac{3}{4}$ D; while for + 2 D sph. the pupillary edge shadow is indeterminate; by the old method of measuring from the pupillary edge shadow the required glass would be − $\frac{1}{2}$ D cyl. ax. 180° c + 1 D cyl. ax. 90°, and while this glass will on trial be found to raise V to $\frac{18}{20}$ — $\frac{18}{15}$, it will not give $\frac{18}{15}$ Snellen, which it should do. Again, retinoscopy is not at fault. Let us look more closely. Let us take first, as before, the horizontal meridians, holding a + 1 D sph. before the eye, O.D., we find that the pupillary edge shadow moves with the mirror; but if we look we shall see that the shadow cannot be made to move with distinctness further than a point something less than half way from the iris edge to the centre of the cornea, for at this point a second shadow will be seen to originate and one whose movement is distinctly *against* the movement of the mirror; this is the *nuclear* shadow. Now neglecting the pupillary edge shadow and watching this nuclear shadow we find that it takes a + 1$\frac{1}{2}$ D sph. to give for this shadow an indeterminate movement. Hence while the refraction of the cortical part of the lens for the horizontal meridians is − $\frac{1}{2}$ D, that for the nucleus is + $\frac{1}{2}$ D. In the same way for the vertical meridians we find that while + 2 D gives an indeterminate shadow for the pupillary edge or cortical shadow, it requires a + 2$\frac{3}{4}$ D to give the same for the nuclear shadow. Hence for the vertical meridians, while the cortical refraction is + 1 D, that for the nucleus is + 1 $\frac{3}{4}$ D. Hence, further, we should expect the refraction for the nucleus to be + $\frac{1}{2}$ D sph. c + 1$\frac{1}{4}$ D cyl. ax. 90°, which glass before O.D. gives V = $\frac{18}{15}$, with many letters in $\frac{18}{10}$. And following the same methods we find that the nuclear refraction O.S. is + $\frac{1}{2}$ D sph. c + 1 D cyl. ax. 90°.

These two cases are enough to explain the point to be made in this communication. Some time since I reported one case where the nuclear refraction had been determined by retinoscopy. These additional remarks are made, because since then I have been led to believe that the majority of the cases, where heretofore retinoscopy has failed to give results which agreed with the actual visual tests, are to be explained by the fact that our results have been for the *cortex* and not for the *nucleus*. Furthermore, I have found that a much larger percentage of cases gives for the nucleus a refraction different from the cortical part of the lens than I had expected. The recognition of this second, or nuclear, shadow is important and will serve to give additional value to the most valuable test we have for determination of refraction of the eye. Sometimes the pupil will not dilate sufficiently to allow us to distinguish between these two shadows, even though they exist. Sometimes it requires careful watching to *catch* this second shadow, but its recognition and its interpretation will serve to clear up doubts "about what glass to give." For the nucleus represents the constant element ; the cortex, the element that is capable of variations to suit varying distances, *i. e.*, the accommodative element in the refraction of the lens. And in prescribing glasses we may neglect the element that in refraction is subject to perpetual variations in the acts of accommodation—correcting the fixed error.

CONTRACTION OF THE VISUAL FIELD IN TRAUMATIC NEUROSIS.

By Dr. E. FISHER, of Dortmund.

Translated by Dr. J. A. Spalding, Portland, Me.

AFTER the publication of 33 cases under the above title by Oppenheim, it might seem superfluous to add only two more, were it not for the fact that Oppenheim's views have lately been contradicted by several competent observers. Schultze in particular asserts that in many cases of functional diseases after injury the contraction of the visual field and the anæsthesia *did not occur*. Out of twenty of his own cases, fourteen exhibited a normal V. F., one or possibly two were slightly contracted, three were very doubtful, and in one the measurement was impossible. And of the local anæsthesia, he says: "I only discovered it in three cases out of twenty-three, and even in these three I was not sure that I could rely on what the patients said."

More than that, he refers the disturbances of motion to hysteria, and the long train of symptoms of sleeplessness, pressure in the head, tremulous muscles, motor weaknesses, painful sensations in sacrum and back, violent throbbing of the heart, and so on, to neurasthenia, till of Oppenheim's clinical picture there is nothing left but a name, and the suggestion that traumatic neurosis is nothing but the last refuge of the malingerer.

Although I cannot but acknowledge that a good deal of nonsense may be carried on under the name of "traumatic neurosis," yet I am convinced that there are typical cases which deserve the name that has been given to them.

Amongst these I would like to publish the following, which, beside exhibiting all the prominent symptoms, occurred in a patient who could not possibly be a malingerer as the history will plainly show.

The patient, aged forty-eight, had been for some years the superintendent of large manufactories in Dortmund, but had given notice of resignation of the position in August to assume a better position in similar manufactories in a neighboring town.

Before assuming the new place he met with a railroad accident which placed him in the fatal position of being compelled to give up his old situation and yet to be unable to accept the new one. He was leaning out of the window when a collision occurred, and whether he hit his head against the frame or not he cannot recall. But the only direct result was a swelling on the occiput. He walked to the nearest station where his agitated appearance attracted general attention.

From this he suffered from sleeplessness, pressure in the head, vertigo, and psychical depression. His eyes felt as if sinking into his head, and then again as if bursting out of the orbits. The old convex lens formerly used in reading did not now prevent rapid exhaustion of the eyes for near work. His memory was defective, and the turmoil and bustle of the great factory unendurable.

My examination on May 27th showed normal vision, slight contraction of V. F. for white and considerable contraction for colors. Four weeks later the contraction for white had noticeably increased.

The entire head showed diminished sensitiveness, variations in temperature, and lack of sensibility to the head or point of a pin. The latter was also well marked on the back and extremities. There was also lack of co-ordination, and use of the feet, but no symptoms suggesting cerebro-spinal disease.

Professor Uhthoff who saw the patient in consultation emphasized the abnormal pupil reaction, "in that with peripheral illumination of the retina and the use of slight variations in light, the pupil contracts very rapidly."

The prognosis of this case is, as any one can see, very unfavorable.

This is the most remarkable case that I have ever observed and I doubt if there can be any malingering here.

It is well known that Oppenheim does not stand alone in his discoveries of concentric contractions of the V. F., and that several of his cases have been verified as correct, by Schweigger, Uhthoff, and Wilbrand.[1]

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[1] For the sake of brevity the second case here reported and the visual-field charts have been omitted in the English edition of these ARCHIVES.

(H. K.)

DISLOCATION OF THE LENS INTO THE ANTERIOR CHAMBER WITH IRIDODIALYSIS; EXTRACTION; RECOVERY.[1]

By C. ZIMMERMANN, M.D., Milwaukee, Wis.

M. B., a healthy-looking man, fifty-three years old, came to me November 3, 1892, with the statement that at 1 A.M. he had received a severe blow on his left eye with the stick of a whip by a man whom he attempted to push downstairs. A surgeon was sent for at once, who put a stitch through a wound of the upper lid, below the eyebrow, 2 *cm* long, and referred the case to me in regard to the eye. There was another more superficial wound of the lower lid near and parallel to the ciliary border, 1.50 *cm* long, which had not been sewed. Both lids were very much swollen and the ocular conjunctiva chemotic. There was no penetrating wound of the globe, but the lower nasal third of the iris was detached from its ciliary border. The pupil was drawn upward and the margin, formed by the separated portion of the iris, was changed into a straight line. The natural and the traumatic pupil looked black; no blood in the anterior chamber. The severed part of the normally blue iris had a green hue and lay farther back than the remaining iris. The cornea showed striated opacities, chiefly in a horizontal direction, the seat of which appeared to be Descemet's membrane. On ophthalmoscopic examination, the artificial as well as the natural pupil gave a red reflex, and in the latter a dark arc with its convexity upwards was noticed, the border of the lens, the lens being dislocated into the anterior chamber. The detached portion of the iris was magnified through the lens, and the green tint seen to be due to the amber color of the latter. V = fingers in 5 feet. V. F. normal. No double vision. A pressure bandage was put on. Chemosis and the corneal opacities disappeared in a few days, and the lens became much more clearly visible, looking like a drop of oil in the anterior chamber.. The eyeball still red, the upper lid œdematous, but there was no pain at all. Tension not increased. Nov. 18th he complained of pain on the top of his head and at the infra-orbital margin. Nov. 19th he slept well, but the œdema of upper lid not disappearing and the eyeball being redder with increase of intraocular pressure, I advised extraction of lens. The patient consenting, I removed the lens Nov. 20th under aseptic measures, with von Graefe's knife, by upper corneal section, the apex of it 2 *mm* below the limbus. Although vitreous prolapsed as soon as the incision began, I quietly finished it. The speculum was removed at once and the lens expelled within its capsule by gently pressing the lower lid with my left index finger on the lower part of the eyeball towards its centre, while I directed the upper lid and the peripheral edge of the wound with my right forefinger. The patient, being very unruly (despite cocaine) lost some vitreous. After he was bandaged he complained of pain in the eye, which however was promptly relieved by antipyrine. Nov. 24th the first change of dressing (4th day). No discharge, wound nicely closed, no prolapse of iris. At the temporal corner of the wound a small gray thread of vitreous projected, which I left undisturbed, lest by snipping it off the wound might burst, until Dec. 27th, when I cut it off. Feb. 9th V with + 10 D = $\frac{15}{200}$.

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[1] Read at the Wisconsin State Medical Society, May 4, 1893.

Details of the fundus can be seen, although a little veiled by slight opacities of the vitreous, appearing in horizontal wave-like dark lines. The eye is without the least irritation. The detached portion of the iris has now the same color as the remainder. This piece being in the centre, it impairs the sight to a certain extent. The patient however mostly uses his artificial pupil and is not annoyed by monocular double images. So far I thought it to be too great a risk to cut this piece with intraocular scissors, as not much could be gained.

Some features in this case deserve especial attention:

1. The manner in which the injury happened is quite interesting. The blow must have struck the upper portion of the eyeball with such vehemence, that the upper periphery of the lens was pushed backwards and turning on

its transverse diameter as axis was driven with its lower periphery against the iris, tearing the latter from its ciliary margin and entering through this gap into the anterior chamber, so that the posterior surface of the lens was now in front and towards the cornea, the lower lens border turned upwards.

2. The great force of the blow explains also the absence of hemorrhages from the ruptured blood-vessels of the iris.

3. In regard to the corneal opacities seen at first, the objection might be made, that I erroneously located them in the cornea, whereas they were in reality in the lens touching the cornea, and were analogous to the apparent opacity of the lens, which may be observed, when after sudden advancement of the latter by evacuation of the aqueous, the layers of the lens suffer a displacement along each other within the capsule and reflect incident light like a soft cataract (*cf.* Becker in *Graefe-Saemisch*, v., p. 280). But then they would not have disappeared as they did after a few days, as the lens did not change its position next to the cornea. In my opinion they represented the optical appearance of wrinkles of Descemet's membrane and the deeper corneal layers, in a horizontal direction, caused by a compression and flattening of the eyeball from above downwards, in consequence of the blow acting from above. Thus the horizontal meridian of the cornea was stretched and its radius elongated, that of the vertical meridian shortened. Hess (*von Graefe's Arch.*, xxxviii., 4, p. 1) proved anatomically and experimentally, that the striated opacities of the cornea after cataract extractions are to be explained in the same way (the direction of the compression only differing from that in our case). They consist in wave-like wrinkles of the deeper corneal strata and are produced by the difference in curvature of the vertical and horizontal meridians of the cornea, the radius of the vertical meridian becoming larger after the opening of the eyeball, acting as if the eyeball was compressed from both sides. In our case the opacities disappeared very soon, the eyeball gradually reassuming its natural curvature, thus furnishing a further support of this explanation.

CONGENITAL UNILATERAL ANOPHTHALMUS.[1]

By C. ZIMMERMANN, M.D., Milwaukee, Wis.

CONGENITAL anopthalmus is mostly bilateral and has been found to occur in different degrees, either limited to the eyeball, or to the eyeball and the optic nerve and its central terminations, or even associated with defect of a large area of the brain. The adnexa of the eyeball are mostly developed. Unilateral anophthalmus, called also monophthalmus, is much rarer. (It must not be confounded with cyclopia, which means confluence of both eyes into one double eye in an abnormal place, viz., at the region of the glabella.) The time of its development is attributed to a late period of fœtal life, if only the globe is missing, not its appendages. In most cases remnants of a globe were left, sometimes not as large as a pea, characterized as such by the presence of choroidal pigment. Others showed orbital cysts, starting from such rudiments, and in others no trace of an eyeball could be detected. The theory is, that by external causes the eyeball at first well developed suffered an arrest of evolution, and consequently degeneration and complete destruction. Nearly all observations were made in children. I saw a case in an adult, which, as it exhibited some other malformations besides, may be of sufficient interest for a short communication.

The patient, a robust man, thirty-three years old, six feet one inch high, weighing two hundred and twenty-seven pounds, is perfectly intelligent. He is the third child of healthy parents

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[1] Read at the Wisconsin State Medical Society, May 4, 1893.

(not consanguineous), and neither these nor his sisters and brothers suffered from any malformations. The right eye is perfectly healthy and normally shaped in all its portions and appendages, V , V. F., and ophthalmoscopic condition normal. The left eyeball is wanting. Its adnexa are in their normal place and all developed, but of diminished size. The lids are smaller, the upper one slightly entropic with its ciliary margin touching the lower one, which is a little ectropic. The palpebral fissure is 2 *cm* long (in right eye 3.5 *cm*). Caruncle, lachrymal points, and lachrymal gland are there, tears flowing from the eye just as from its fellow on irritation. After insertion of lid-retractors a diminished empty conjunctival sac is exposed, in the depth of which no trace of an eyeball can be seen nor felt. The finger finds a soft cushion, feeling as the contents of the orbit do after enucleation. The conjunctiva at the bottom of the sac looks a little whitish from the underlying Tenon's capsule. The presence of the ocular muscles becomes evident by their action, as the sac moves in all directions in association with the other eye. Neither pressure nor the faradic current creates any sensation of light, so that absence or degeneration of the optic nerve may be inferred. The left orbit is considerably smaller than the right. The height at the supra-orbital foramen : L, 2 *cm ;* R, 3 *cm.* Greatest horizontal width : L, 3 *cm ;* R, 4 *cm.* Left eyebrow 5 *cm* long ; R, 6.5 *cm.*

The skull is asymmetric, the left portion of face and forehead being smaller than the right. The left side of the forehead is receding as well as the hair on this side. The following measures were taken with the compass : Longitudinal diameter (root of nose to occipital protuberance), 18 *cm.* Root of nose to tuberculum radicis arcus zygomatici (above and behind the ear) L, 12 *cm ;* R, 12.5 *cm.* The width between both ears, *i. e.*, between the above-mentioned tubercula, 15 *cm.* Width between both tubera parietalia, 16 *cm.* Distance of external walls of both orbits, 10 *cm.* Figures obtained with tape-measure : Horizontal circumference of head, taken from centre between both arcus superciliares to occipital protuberance, 56 *cm.* The left (pathological) half of it measures 29 *cm*, the right only 27 *cm*, the left parietal bone showing a greater extension than the right, compensating for the diminished size of the left side of the forehead. Root of nose to the external wall of left orbit, 6 *cm ;* of right orbit, 7 *cm.* Frontal arch between the roots of both arcus zygomatici, 32.5 *cm.* The patient has a cranium progenæum, the lower jaw forming an overbite over the superior maxillary. The palatal vault is very high and narrow. The left superior maxillary is smaller than the right and has one tooth, the canine, less than the right. The posterior wall of the pharynx projects more on the right than on the left side. In posterior rhinoscopy the left choana appears to be smaller than the right. The deviation of the nasal septum to the right in front is due to a fracture he suffered when fifteen years old.

The left auricle shows also a deformity. Its lobe is rudimentary, and the whole auricle looks as if it had been rolled up in a forward direction and drawn forward. Its posterior aspect nearly forms a plane, without bends and elevations, and stands out at right angle with the head, so that the anterior limit of the helix lies in one frontal plane with the posterior wall of the external ear opening. In a profile view it seems to cover half of the concha. In the skin, 0.75 *cm* in front of the tragus, is an elevated scar 1 *cm* long (vertical diameter) and 0.56 *cm* wide (sagittal diameter) where, according to the patient's statement, the auricle was attached at birth and was severed by operation soon afterwards. A small scar at the posterior surface of the helix corresponds exactly to that place. When the auricle is rolled forward, both scars touch each other. After the inspissated cerumen was removed, the auditory canal and *Mt* appear perfectly normal, as well as the hearing power, so that the malformation of the hearing organ is limited to the auricle. There is no other asymmetry, except that the left foot is thicker than the right.

The story the parents give in this case is this: The boy was born in a position in which he held his left hand on the left eye, pulling the left auricle forward with his fingers. The eye was wanting, and the ear was firmly attached to the head. The left leg was drawn upward and, when stretched, tended to return to that position, so that it had to be fixed on splints. Hœderath (Ueber Monophthalmus congenitus, Inaug. Diss., Bonn, 1871) described two similar cases observed in the eye-clinic at Bonn, one of which is just like ours, if not the same, since our patient has been examined by Professor Sæmisch of Bonn in 1867, when seven years old. Hœderath, however, reports his age as eleven years and gives a different first initial. He writes, that the left arm retained the same position on the eye as at birth for a fortnight afterwards. Manz (*Græfe-Sæmisch*, ii., p. 125), in quoting this case of H., seems to consider the anophthalmus to be of traumatic origin, caused by the pressure of the hand, leaving it undecided whether the peculiar position of the arm may have been due to a constriction by amniotic threads, or the umbilical cord. If this had been the case, the constriction must have been very firm, so that we would expect to find some traces of it on the arm or hand, an atrophic spot or a scar, or some other malformation, but there was nothing of the kind. As not only the eye and ear, which alone might have suffered from the pressure of the hand, but even the whole left side of the head were defective, this factor loses its value as the only cause of the malformation. The child's condition at birth not having been communicated by an expert, we are not allowed to adopt at once the parents' pretty vague narration and base theories on it. The father told me that at first they thought the midwife had injured the eye and had invented that story for her exculpation. Apparently he had not seen the asserted position, nor had the mother, as they at first tried to conceal from her the existence of such a deformity. The case however is of especial interest, as being one of those rare instances in which the anophthalmus was observed in an adult, and corroborating the assumption that this malformation was due to an arrest of development, with consequent destruction of the eyeball in a pretty late period of fœtal life, when the eyeball was already developed, as we infer from the presence of its appendages, and not caused by a primary deficiency; else we could not expect such perfectly healthy mental and otherwise bodily development as seen in our patient.

EXTRACTION OF PART OF THE CAPSULE AS AN OPERATIVE PROCEDURE IN CERTAIN CASES OF SECONDARY CATARACT.

By JOHN DUNN, M.D., Richmond, Va.

Mrs. Vest, aged seventy-four, consulted me in August, 1892, in regard to her eyes. Diagnosis, double cataract. Lenses were, however, clouding in flakes and very slowly. Advised ripening and extraction. Patient disappeared. Reappeared on April 14, 1893. Mrs. V. had been to another city, where Förster's operation for ripening had been done, after which extraction and then capsulotomy. Result: Vision nothing, or, rather, bare perception of light. Examination of the eye showed a well knit corneal extraction scar; a well made, complete, upward coloboma of iris, whose edge was apparently everywhere, except perhaps centrally below, adherent to a thick capsule, in which there was no opening. In the centre of the coloboma below, viewed from above, there was apparently communication between the anterior and posterior chambers, through an opening perhaps ½ to 1 *mm* in diameter. The thickened capsule, however, extended below the iris edge so that no light entered the eye through this opening. *Tension above normal.* Signs of slight circumcorneal irritation. No pain on pressure, although patient wore dark glasses. She had been using atropia constantly since date of last operation, but it had had no effect on the iris.

The question here was the best method of treating this condition of the eye. About two years ago I had under treatment a similar case, where, owing to the thickness of the capsule, I was unable to obtain in it a permanent opening and where my attempts to do so resulted in glaucoma, which hot applications, pilocarpine internally and to the eye, atropia, repeated paracenteses and even iridectomy failed to give more than temporary relief. What would have been the final result I cannot say, as the patient died from an attack of la grippe while the eye was still under treatment.

So, too, in the case of Mrs. Vest, the capsule was too thick to hope for success from a needle operation, which the adhesion of the iris to the capsule rendered unsafe ; for, as said above, this adhesion was complete, except for a minute space below. Atropia was useless. The tension of the ball was at least in direction of glaucoma. Left to itself, the eye was useless for the purpose of vision. Several times within the past two years it has occurred to me that in these cases of thickened capsule capsulectomy was not only justifiable, but demanded. In the case of Mrs. Vest, I thought that a further needle operation was contra-indicated, and that the best means of obtaining vision was in section and removal of a square of the capsule. This was done as follows : A *sharp* capsule knife was forced through the cornea near its upper edge and then through the anterior chamber to the iris border below. Two parallel cuts were then made in the capsule from below upwards and these cuts then joined below. Of course, the lines of incision were more or less irregular, and some tearing rather than cutting had to be done. The result was a capsular flap, attached above. No manipulation of this flap could make it give a clear pupillary space. There was some traction on the iris as shown by a minute hemorrhage at its lower pupillary margin. The tension of the ball was somewhat lowered by the escape of part of the aqueous. With a small cataract knife a corneal section 3 *mm* in length was then made along the upper corneal edge. A pair of iris forceps was then introduced through this wound and the floating flap was seized. I intended to cut this flap off with a pair of scissors should there be any traction in the iris. It, however, came away without trouble. The escape of vitreous was not more than a drop. The flap was 4 *mm* long, 2 *mm* broad, and there resulted a correspondingly large, clear, black pupil. The eye healed without complication. June 4, 1893, $V = \frac{1}{6}$ with a + 11 D sph. c + 2 D cyl. ox. 180°. The capsular opening remains clear ; and the signs of irritation about the eye have disappeared. That the vision is not better is, I think, to be attributed to the fact that the capsular pupil is excentric. A fringe of thickened capsule, to which the iris is adherent, protrudes everywhere beyond the edge of the iris. The nerve can be seen and is apparently in good condition.

This operation of capsulectomy is, I think, justifiable not only in cases, like the above, where the iris is everywhere adherent, as far as can be seen, to a thickened capsule; but also in those cases where, following extraction, the capsule is much thickened, the iris remaining free.

D-0.50

LEFT COOT FELT FOOD
COOL FEET CLOD LOLL
FEEL LODE DEFT DOTE
DOLL TELL TOOL CELT

D-0.75

COO LEE OLD ELF
FEE COD LET TOD
ODD EEL TOO OFF
ELL DOT FOE COT

D-1.00

LEET COLT LOFT
FOLD FEED DELL
TOLL TOLD FOOL
DOLE FELL FLOE

D=1.50

CODE DOLT
FLED LOOT
COLD DOLL

D=2.00

FED LOO
ODE TOE
LOT OFT

A NEW SERIES OF TEST-WORDS FOR THE DETERMINATION OF THE POWER OF ACCOMMODATION.

By CHARLES A. OLIVER, M.D.,

ONE OF THE ATTENDING SURGEONS TO WILLS' EYE HOSPITAL, ONE OF THE OPHTHALMIC SURGEONS TO THE PRESBYTERIAN HOSPITAL, AND CONSULTING OPHTHALMIC SURGEON TO ST. AGNES' HOSPITAL, PHILADELPHIA, PA., ETC.

(*With a specimen-sheet appended.*)

THE accompanying sheet of test-words possesses the following advantages:

1. Each word is composed of three or four letters that are constructed in strict conformity with the Snellen basis of letter formation, thus not only avoiding any errors that might arise from improper characterization, but actually placing the results upon the same basis as those that are obtained during testing for distant vision.[1]

2. Each column of words, just as in the rows of test-types for distance, has a purposive succession of test-words that are alternately composed, as much as possible, of letters that are preponderant in horizontal and vertical strokes, and in curved ones, thus allowing the tests to be of great value in the ready recognition of astigmatism.

3. Each grouping of letters is composed of a different series of words which bear no relation to one another, thus preventing any power of memorizing, and any imperfections in result that might arise from context.

4. Each test-letter, just as in the larger series, is surrounded by a free space which is either equal to or greater

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[1] *Vide* p. 200 of these ARCHIVES, April, 1893.

than the area that is occupied by the letter itself, thus greatly obviating any confusion that might arise from interference of one letter with its fellow.

5. Each grouping of test-words, which has been made sufficiently great so as to allow an adequate change of choice of selection during testing, is graded to a size that permits of easy and quick computation.

6. The letter-surface of the card is surrounded by a broad raised border of rough gray cardboard, thus in great measure preventing the print from being soiled by handling or by contact with any dirty surface.

Copies of this card can be obtained from Mr. William S. Yarnall, of 1406 Chestnut Street, Philadelphia, Penna., who has kindly superintended their construction.

MOVEMENTS OF THE UPPER EYELID ASSOCIATED WITH LATERAL MOVEMENTS OF THE EYEBALL.

By Dr. HARRY FRIEDENWALD, Baltimore.

LECTURER ON OPHTHALMOLOGY AND OTOLOGY, COLLEGE OF PHYSICIANS AND SURGEONS.

SYNCHRONOUS or associated movements of the upper eyelids have recently attracted much attention. Numerous observations have been published of lid movements associated with movements of the jaw or with the act of swallowing.

Another form of associated lid movement has lately been described by Fuchs.[1] In this form the lid rises or droops when the eyes are moved laterally. Fuchs found but three cases hitherto published in which similar associated movements were observed. In five of his own cases the upper lid was raised when the corresponding eye was adducted, and in three the same lid movement occurred during abduction of the eye. He cites the case of Browning,[2] which belongs to the former variety, and the two cases (brothers) of Phillipps,[3] belonging to the latter. These are the only cases recorded in which such observations have been described. In this paper I shall describe two cases which have come under my observation. Both belong to the second variety of the associated movements just mentioned.

Case i.—Miss S. W., æt. eleven, came to my office July 6, 1891, complaining of slight asthenopia. The right eye appeared normal, but the left was smaller and lay deeper in the orbit. The examination with the ophthalmoscope showed that both eyes were healthy. V R. E. with + 0.5 D cyl. ax. vertical $\frac{8}{8}$ almost, V L. E. $\frac{8}{18}$, not to be improved with glasses. Besides this it was found that the movements of the left eye toward the nose were somewhat restricted, but that there was almost complete paralysis of the external rectus muscle. In testing these movements of the eyeball, the synchronous movements of the upper lid attracted my attention. When the eyes are directed forward the left palpebral fissure is 2 – 3 *mm* narrower than the right. When the attempt is made to look to the left, the left upper lid is raised so much that the palpebral fissure is as large as on the right side. If the eyes are turned to the right, the left palpebral fissure becomes very narrow. The difference in the palpebral fissure in the two extreme lateral positions of the eyes is very great. This patient had binocular vision when the eyes were directed forwards. It was ascertained by the test with cylindrical glasses as suggested by Lippincott.[1]

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[1] *Beiträge zur Augenheilk.*, ed. by Deutschmann, vol. ii., No. 11, p. 12.
[2] *Transac. of the Ophthalm. Soc. of the United Kingdom*, 1890, p. 187.
[3] *Transac. of the Ophthalm. Soc. of the United Kingdom*, 1887, p. 306.

I have recently succeeded in securing a second and more careful examination (July 30, 1893), and I find my observations of two years ago almost unchanged. When the patient looks directly forward the right palpebral fissure measures 11 *mm* vertically, the left 7 *mm*. On looking to the right, the latter only measures 4 to 5 *mm*, while the former remains the same; but on directing her vision to the left, the left eyeball remains stationary in the median line and the lid is raised as high as on the healthy side. There is slight convergent strabismus when she looks directly forward (10°). This is a marked change since the first examination. When her left eye is used alone she can adduct it to 40° (measured on the perimeter), but when both eyes are open and the attempt is made to look in the same direction, the left eye is adducted but slightly and is turned upwards or downwards according to whether the plane of vision is slightly above or below the horizontal. When the left eye fixates the palpebral fissure widens, and when she attempts to abduct the eye the fissure enlarges sufficiently to expose sclerotica, above and below the cornea. If the eye is then adducted to the greatest possible extent, the eyelids almost close. There is no apparent effort at convergence, and the left lid remains stationary when the eyes are directed from a distant object to a near one. The left upper lid follows the upward and downward movements of the eyeball in a normal manner. The pupil does not change during the lateral movements of the eye. The vision of the left eye can be raised from $\frac{8}{18}$ to $\frac{8}{12}$ by + 0.5 Ds = + 0.75 D cyl. ax. 30°n. The field of vision is normal. The test for binocular vision is successful only when the object is held a little to the right. No diplopia can be discovered in any part of the field.

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[1] See Lippincott, "New Tests for Binocular Vision," *N. Y. Med. Journ.*, 1890, and my paper "Binocular Metamorphopsia Produced by Correcting Glasses," these ARCHIVES, vol. xxi., No. 2, 1892, p. 211.

In this case the ocular paralysis was congenital according to the statement of her relatives, and this is substantiated by the fact that the patient has an undeveloped eye and orbit.

Case 2.—B. C., æt. seventeen (female, white), was treated at the City Hospital Dispensary during May, 1893, for vascular keratitis of the right eye due to granular conjunctivitis (limited to this eye). I noted complete paralysis of the left external rectus with very slight convergent strabismus (not more than 5° or 10°) when looking directly forward. The vision of the right eye was somewhat impaired on account of the corneal opacities, but the eye was otherwise healthy. The examination of the left eye with the ophthalmoscope showed no abnormality excepting a high degree of astigmatism. This accounted sufficiently for the diminished vision of this eye ($\frac{6}{30}$). Diplopia could not be produced in any way, either when looking forward or laterally. For this reason it was remarkable that the patient had the habit of turning her head a little to the left when looking at an object; her eyes were thus directed somewhat to the right—evidently in the interest of binocular vision.

When the patient's eyes are directed forwards, the left eye is slightly wider open than the right. The right upper lid touches the margin of the pupil; in the left eye about ½ *mm* of iris is exposed between the margin of the pupil and the edge of the upper lid. The right palpebral fissure does not vary during the lateral movements of the eyeball, but the left changes considerably. When eyes are moved to the right or when the eyes are converged (adduction of the left eye), the upper lid falls about 2 *mm*—so that the pupil is half covered and the palpebral fissure is much smaller than on the right side. On moving the eyes to the left (the left eye does not move beyond the median line), the left palpebral fissure becomes so wide that about 1 *mm* of sclerotica is exposed above the cornea. Similar lid movements occur when the eyes are moved laterally, either in an elevated or in a lowered plane of vision. No pupillary changes were visible during these movements.

In this case likewise I believe that the affection is congenital. The patient has no diplopia, and does not remember ever to have had it. There is no secondary contraction of the antagonist —the internal rectus, a peculiarity of congenital paralyses.

It would be difficult to decide whether the paralysis in the two cases just related is nuclear or not.

Fuchs' cases, in which the lid was raised in abduction of the eyeball, are as follows:

1. Male, twenty-nine years; ocular movements normal. On looking directly forward no difference is noticeable in the palpebral opening on both sides, but when the right eye is adducted the eyelid droops. The affection was probably congenital.

2. Male, forty-five, syphilitic. Right eye: Slight ptosis and paresis of the internal rectus, pupil dilated, and the accommodation paralyzed. This condition disappeared under treatment with potassium iodide, but at the same time the like affections appeared in the left eye. It was then that the left upper eyelid showed the associated movements under consideration,—it was raised in abduction of the eye, but drooped in adduction. A year afterwards the ptosis had entirely disappeared, and likewise the associated movement. There was absolute paralysis of convergence (though the lateral movements were normal), the pupils were unequal and stationary, and there was paralysis of the accommodation.

3. Female, æt. twenty. Paresis of the external recti muscles, especially of the right, and slight ptosis of both upper eyelids, slightest on the left side. (The ptosis on the left side soon disappeared.) In looking to the right, the eyelids remain in the same position, but in looking to the left the eyelids fall 2 *mm.* In convergence or when the eyes are raised or lowered, there are no peculiar movements of the eyelids. In this case there was relaxation of the right lid in adduction, and of the left in abduction.

Now all of these cases differ markedly from those I described. In the first there was no ocular paralysis, a prominent feature in both of mine. In the second there was paralysis—but of the *internal* rectus, and ptosis; these symptoms, however, occurred during adult life—and were not congenital. The third case had paresis of both external recti muscles, but while the right lid drooped in adduction, the left drooped in abduction. In the case of Phillipps, quoted by Fuchs (see above), the affection occurred in two brothers, aged seven and three years respectively, and was bilateral in both. There is no mention of any ocular paralysis.

A careful study of these cases shows that the peculiar associated movement under consideration may occur in a variety of conditions—without any paralysis or with paralysis of the external or of the internal rectus,—and that it may be congenital or acquired.

For the sake of completeness I shall refer briefly to Fuchs' cases in which an associated movement existed, opposite in kind to the form we have considered. In these cases the upper lid was raised during adduction of the eyeball. His five patients were all adults. In one only was the affection congenital. All had ocular paralysis (probably nuclear); three had paralysis of all the ocular muscles, one of the superior rectus and levator palpebræ, one of the superior and internal rectus with slight paresis of the inferior rectus). In three of the cases the contraction of the paretic upper lid was so great during adduction of the eye that it rose higher than on the healthy side. Two of the cases showed contraction of the pupil during adduction, and in one there were interesting rhythmic associated movements of the lid and pupil. To these cases we must add the last one of Fuchs' mentioned under the former head of associated movements, in which the right lid relaxed in adduction, while the *left relaxed in abduction*, and also the case of Browning referred to by Fuchs, in which there was a congenital associated movement in both lids—each was raised whenever the internal rectus of the same side contracted. As in the foregoing variety, it is seen that these likewise occur in a variety of conditions.

The associated movements which have been described belong, as Fuchs has already stated, to the same category as those involuntary movements which occur in paralyses of the extremities.[1] The excessive nerve energy which is applied to the paralyzed nerve overflows into another channel. Fuchs calls attention to the fact that this must occur in the nuclear centres of the ocular nerves, for if it occurred in higher centres the impulse would be directed to both eyes.

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[1] Excepting, perhaps, such cases as Browning's, which, according to Fuchs, may be considered physiological.

In conclusion the various forms of associated movements of the lids may be stated.

1. Contraction of the orbicularis associated with movements of the jaw or the contraction of various facial muscles (after facial paralysis).

2. Contraction of the levator palpebræ superioris associated with the act of moving the jaw or of swallowing ; and,

3. Contraction of the levator associated either with abduction or with adduction of the eyeball.

ON ORBITAL LOWER-LID CYSTS WITH MICROPHTHALMUS OR ANOPHTHALMUS.

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Translated by Dr. Ward A. Holden.

(*With Plates VI. and VII. of Vol. XXV. of German Edition.*)

HAVING made a detailed histological examination of a case of this sort I believe I am able to offer an explanation—probably the only correct one—of the pathogenesis of the affection.

The cases previously reported are as follows:

1. Arlt[1] was the first to call attention to this congenital anomaly. In his case, an infant of nine months, the lids were present and between them a conjunctival sac, in the depth of which a small projecting body could be seen in each orbit. Each lower lid was pressed forward by a large, dark blue transparent cyst. Arlt explained the case as one of coloboma of the iris and choroid with the formation of a large diverticulum by the bulging of the ocular coats inferiorly, the eyeball proper remaining of rudimentary size. When examined after the death of the infant the suppositions of Arlt were in the main confirmed. The six ocular muscles were found and the optic nerve with a vesicle 2.5 *cm* in diameter adherent to it. This cyst, which was filled with albuminous fluid, showed near the insertion of the optic nerve a rudimentary lens in an opaque capsule. and also elements of the choroid and retina, while no trace of vitreous, iris, or cornea could be discovered.

2. Wallmann[2] reported a typical case in a child of four years. The lower lids were prominent from the presence of a cystic tumor. The ball was transformed into an irregular vesicle provided with six muscles, and thickened near the optic nerve, where lay partially imbedded a round lens 3 *mm* in diameter. The cavity of the vesicle communicated in each eye with a bulged portion of the ocular coats having smaller secondary diverticula. Near the optic nerve, retinal and choroidal elements were found. Since these elements were also found in the diverticula, Wallmann distinguished true and false diverticula, the former being made up of all three ocular coats, and in the latter the inner coats being wanting.

3. In 1863 Arlt[3] examined clinically another typical case in an infant of nine months, where both eyes were similarly affected, a small hard spot being felt in the depths of the conjunctival sac. The father had marked microphthalmus with coloboma of the iris—left, and coloboma of the optic nerve and choroid—right; the left half of the face being less developed.

4. De Wecker[4] observed an infant of six months with prominent bluish lower lids. No ball could be felt. The aspirated contents of the cysts were found to be similar in composition to the aqueous humor.

5. Chlapowski[5] observed a cyst in the orbit of a boy of sixteen. No ball could be found though the mother stated that she had previously seen a white object in the orbit about 2 lines in diameter. The cyst was extirpated. In the operation some hard object was cut through which Chlapowski took to be the optic nerve. He believed that a bulging of the anterior pole of the cyst represented the cornea. When the patient was discharged a small white spot was found in the depth of the conjunctival sac the nature of which was uncertain. The case, inaccurately described, was considered probably an atheromatous cyst,and led to great confusion in the further study of this malformation.

We come now to the eight cases described by Talko.[6]

6. A suckling; the right eye the size of a hazel-nut; left, a large orbital lower-lid cyst.

7. A child of ten; in the depth of the right orbit a small eyeball with an orbital lower-lid cyst; complete blindness; the left eyeball the size of a nut, and able to distinguish objects.

8. A girl of twelve months; both eyeballs very small, nystagmus, total blindness. A blue cyst covered with conjunctiva in the orbit, from which a yellow serous fluid escaped after incision.

9. Anophthalmia duplex congenita, a blue cyst beneath the lower lid in a girl of ten.

10. Talko's[7] fifth case was an infant of four months, with bilateral orbital lower-lid cysts, and small ovoid eyeballs with a round, transparent cornea in the depth of the orbit. The anterior portion of the cyst wall was excised, and a sound introduced into the cavity convinced Talko that the cyst did not communicate with the cavity or with the eyeball. The inner surface of the excised portion of the cyst was lined with pointed cylindrical epithelium. Talko believed that these were not malformed eyeballs, as he had previously stated, but vesicles which had nothing in common with the eye.

11. Talko's[8] sixth case was an infant of nine months, with a small eyeball in the right orbit.

12. Talko's[9] seventh case was an infant of nine months, with a small eyeball in the right orbit, and in the left a marked microphthalmus with coloboma of the iris.

13. Talko's[10] last case was a woman of forty-two, with a small body in the depth of the right orbit, which moved synergetically with the left eyeball. This rudimentary ball was united with the cyst.

14. Imre[11] reported a case of bilateral cyst with microphthalmic balls.

15. Bayer's[12] case was a female child with a cyst in the right orbit, after the puncture of which a small eyeball, with a cornea 3 *mm* in diameter, appeared.

16. Berlin[13] reported a unilateral case with apparent anophthalmus. A younger child of the same family showed a bilateral microphthalmus without cystic formations.

17. Wicherkiewicz[14] described a case of bilateral anophthalmus, with cysts, in an infant of two months.

18, 19. Manz,[15] in a paper written in 1880, described cases of orbital cysts, which, as he believed, belonged to a new variety. His first case was that of a young peasant who in place of an eyeball had a large tumor, which had distended the orbit. This cyst, with the adherent microphthalmic eye, was excised in two fragments.

Another specimen examined by Manz showed a microphthalmic ball with a cyst near the nerve entrance, composed of scleral layers lined with choroid, no retinal elements being found.

Manz's explanation is as follows: A scleral cyst may become greatly enlarged, and may also be cut off from the ball so that the former communication may be represented only by a fibrous cord. Or, since the inner scleral layers which rest on the choroid may probably be separated from the outer scleral layers by the increase of the cystic fluid, this dehiscence of the scleral layers may increase in every direction and include the greater portion of the ball. The cornea and optic nerve form the limits of such an extension. Manz believed that he had discovered a new mode of formation of orbital cysts in genetic conjunction with the eyeball, the other modes, that of hydrophthalmus and ectatic coloboma, being fairly well understood.

In my opinion, Manz's first case was one of orbital dermoid cyst with a microphthalmic eyeball, the development of which had been arrested at a very early stage. In the second case, the specimen was too badly preserved to permit any definite conclusions to be drawn from its examination.

20. Scerebitzky[17] reported a bilateral case in an infant of six months. There was anophthalmus and an irregular white spot in the depth of the orbit.

21. Van Duyse's[18] case was a man of twenty-two, with an orbital lower-lid cyst on the right side. The right eye appeared to be absent, but was discovered after the puncture of the cyst. The left eye showed a slight degree of microphthalmus with coloboma of the iris, choroid, and nerve sheath. The choroidal coloboma was characterized by marked secondary bulgings of the ectatic sclera. Two

younger brothers, dead in infancy, had hare-lip, and one of them cleft palate also. Van Duyse concluded that in these cases a coloboma had been transformed into a cyst (colobome encysté).

22. In Schaumberg's[19] case, an infant of six weeks, there was a cyst in the left orbit with bilateral anophthalmus; the orbits appearing to be small.

23. Dor[20] described in an infant of six months a fluctuating bluish tumor, somewhat larger than a normal eye, in the infero-internal angle of the right orbit, to which was adherent a microphthalmic eye with coloboma of the iris. After removal of the cyst, no communication was found with the eye. On the other side there was microphthalmus with coloboma of the iris and choroid. Objects were seen with this eye. Dor believed that in fœtal life a portion of the embryonic vitreous, having been cut off outside the ball by a premature closure of the fœtal cleft, had developed into a cyst. At the microscopic examination, however, no embryonic vitreous structure was found, nor an epithelial lining of the cyst, but in the tissue was a spindle-celled fascicular sarcoma. The clinical description of this case leaves no doubt that it was one of orbital lower-lid cyst with micropthalmus.

24, 25. Snell[21] reported two cases. The first, "congenital cyst in the lower eyelid with apparent anophthalmus," was in an infant of one month. A rudimentary eyeball was discovered after puncture of the cyst. A year later the patient was seen a second time. The left incised cyst was again filled with fluid; the right cyst, which had not been disturbed, had vanished, but in the floor of the orbit was a round, non-fluctuating tumor beneath the conjunctiva, apparently either cyst or rudimentary eyeball.

His second case was an infant of six weeks, with a cyst on the left side that completely filled the orbit. The right eye was normal. After extirpation of the cyst an almost normal but very small eye was discovered. Fourteen days after the extirpation, the ball had pressed forward, and later it grew considerably, but did not reach the normal size. The eye was movable, and the child could see with it. There was a coloboma of the choroid.

26. v. Reuss's[22] first case was a child of three months, with left microphthalmus and orbital lower-lid cyst. In the other eye there was a coloboma of the nerve sheath.

27. v. Reuss's[23] second case was a girl of fifteen, with a left microphthalmus connected with the cyst by a thick cord. The right ball was somewhat small, and showed a coloboma of the iris, choroid, and nerve sheath.

28. One of the most important contributions to the subject is that of Kundrat.[24] In his case in the depth of the right orbit was a small pear-shaped eyeball, with cornea and optic nerve, and a lens nearly filling its interior. The ball was open inferiorly and its cavity connected with a gelatinous tissue which lay under it and anteriorly passed over into the lower-lid cyst. The condition on the left side was similar.

Arlt's explanation would not answer for such a case, for here there had been no closure of the fœtal cleft and no formation of a bulging scleral sac.

The left ball showed an inferior cleft 2 *mm* wide, extending to the optic nerve and bordered by the sharp margin of the sclera. The cavity was lined with apparently normal choroid and retina. The retina, much wrinkled, passed through the inferior cleft and formed a lining for the optic cavity below. All the cysts showed an outer fibrous and an inner gliomatous layer, the latter being subdivided into an outer stratum, poor in cells, and an inner, richly cellular. Between the eyeball and cysts was a finely fibrous cellular embryonic connective tissue, which passed over into the sclera and into the outer wall of the cysts. From the anterior end of the inferior cleft extended a narrow cystic cavity lined with a delicate cylindrical epithelium.

From this it appears that, in the genesis of these cysts, the retinal tissue, *i. e.*, the tissue of the primary optic vesicle, pushing through the open fœtal cleft into the embryonic tissues outside, is enclosed and cut off by the latter, thus forming a cyst. Kundrat believes he is correct in supposing the basis of this embryonic tissue to be the mesodermic tissue, which should have formed the poorly developed vitreous. He believes further that the check in the development of the vitreous and in the closure of the fœtal cleft is primary, and that the proliferation of retinal tissue—not its simple bulging out—is secondary.

Kundrat's view is in the main correct, and is, up to the present, the only proven genesis of these cysts, but many of the details are not clear, and his employment of the expression "fœtal cleft" is ambiguous.

29. Ewetzky[25] observed an infant of eighteen months having this anomaly. After emptying the contents of the cyst, a solid cord with a distended end was found—probably the rudiment of the ball. A portion of the cyst wall was examined histologically. It was found to be made up of two layers, the outer consisting of connective-tissue bundles, while the inner was thinner and richer in cells. In other parts a single stratum of cylindrical epithelial cells was found, but here no traces of the tissues described could be seen, and the epithelium rested directly on the outer layer of the wall, and here and there was directly continuous with the finely fibred tissue of the inner layer. It was thus evident that the epithelium and the inner cellular, finely fibred layer were analogous formations.

Ewetzky took the inner layer of the cyst wall to be the undeveloped and altered retina, and the epithelium the pars ciliaris retinæ; the cyst representing then a cut-off coloboma. The outer layer of the cyst wall is to be regarded as a formation analogous to the choroid and sclera, the grouping of the large vessels resembling that of the choroid, and the direction of the connective-tissue bundles recalling that of the sclera. He agreed with Arlt as to the genesis of the affection, and introduced the word "coloboma cyst."

30. Radziszewski[26] in an infant of two months found bilateral anophthalmus with orbital lower-lid cysts. He considered the anomaly a double encephalocele, but was not positive in his diagnosis.

31. Panas[27] extirpated a bilocular orbital lower-lid cyst in a child of twelve years, it not being stated whether the ball was normal or not. The larger cystic cavity was lined with a stratified cylindrical epithelium, while the smaller cavity showed a modified epithelial lining. Panas believed that

the case was one of fœtal involution of the mucous membrane of the nose and accessory cavities.

32. Tillaux[28] saw a unilateral case of this affection in a young man, where the microphthalmic ball was displaced upward by the cyst. According to Tillaux these cysts should be considered diverticula of the sclera according to Manz's view.

33. Ernrot[29] reported the case of an infant of five weeks with bilateral anophthalmus.

34. Max Mayer[30] found this anomaly on the right side in an infant of three weeks. The wall of the cyst was composed of connective tissue, and lined with a single stratum of high epithelial cells. Mayer regarded the connective-tissue wall as the thinned and altered sclera, the epithelium as the analogue of the retina.

35. Lang[31] found the anomaly on the left side in a child of three years. The cyst passed from the inferior surface of the ball and optic nerve, its walls being in unbroken connection with the posterior portion of the sclera and the sheath of the optic nerve. In the ball a brown layer rested on the sclera, and within this a darker pigmented layer, the pigment epithelium of the retina, which latter extended into the neck of the cyst. The portion of the ball adjoining the cyst contained a substance similar to cerebral cortex, in direct continuation with a gelatinous mass. This substance consisted of a network of fine fibres, cells with processes, and scattered nuclei, and resembled retinal tissue. All the layers of the cornea and iris were present, the latter having an inferior coloboma. Lang offered the theory that the cyst had arisen from the primary optic vesicle which had pushed out into the mesodermic tissue of the vitreous.

36. Rubinski[32] described a case in an infant of six months. In the right orbit was a very small eyeball. The left eye was somewhat microphthalmic with coloboma of the iris and choroid. There was no communication between the cavity of the cyst and that of the ball. The outer layer of the cyst was a tissue, poor in nuclei, with a network of vessels, and some fatty material. The inner layer was rich in nuclei and bore a faint resemblance to the retina, it being reversed, however, and the rods and cones pointed inward.

Rubinski, in spite of his careful histological examination, held to the theory of Arlt and rejected that of Kundrat.

37. Czermak's [33] case was of an infant of twelve days with a left-sided affection, the right eye being normal. The cyst wall was composed of two layers, an outer of connective tissue and an inner consisting of retinal elements in reversed position. This arrangement must be due to the development of a portion of the primary optic vesicle which has not undergone involution.

38. The last case in the literature is that of Lapersonne,[34] an infant of five weeks with a bilateral affection. Both optic nerves ended in two fibrous bodies representing rudimentary balls, and were continued inferiorly and anteriorly in orbital lower-lid cysts. The cysts here were lined with a structure resembling a reversed retina thrown into numerous folds. It is difficult to understand by what mechanism the distal layer of the primary vesicle may become almost entirely invaginated and leave but a small portion outside the ball. Furthermore the presence of a lens in the rudimentary ball indicates that the pathological changes must have begun at a late period.

The cyst cavity and that of the ball may communicate freely, or the communication may be narrow, or they may be joined only by a connective-tissue cord, in which case, nevertheless, retinal elements may be found in the cyst. In these different cases it would appear that the malformation had developed before the closure of the fœtal cleft, and the retina might then readily extend outward. To a much later developmental period belong those cases where there is simply a uveal coloboma with ectasia of the choroid. The increase in this ectasia brings about the coloboma cysts of Arlt and Van Duyse (?).[1]

NEW OBSERVATIONS.

CASE 1. *Clinical Observation.*—An infant of eighteen months, with right eye normal, the left upper lid sunken, and the lower protruding from the pressure of a tumor the size of a plum. The conjunctiva on the upper surface of the tumor has no tarsus, and may be readily drawn away from the tumor. The tumor has a bluish color and the appearance of a very thin-walled cyst. The orbicularis muscle has its proper function in the upper lid only. Two *cm* from the margin of the lower lid a thickening of the conjunctiva is felt, 1 *cm* in extent, and adherent to the upper posterior wall of the cyst. When the normal right eye is moved synchronous movements of this thickened mass may be felt. A bluish white spot seems to represent the cornea of a rudimentary eyeball. The orbit presents no other abnormalities. The lachrymal apparatus is normal.

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[1] A more recent case is that of Gailemaerts (*Rev. générale d'opht.*, March, 1893). The patient's right eye was normal, the left was microphthalmic, with a large orbital lower-lid cyst. The cyst wall consisted of two layers, an outer fibrous and an inner granular, but not clearly defined. He holds to the ectatic coloboma theory.—TRANSLATOR.

In this case there could be no doubt but that there was a malformation of the contents of the orbit, consisting in the arrested development of the ball, which remained a nodular mass, and in the formation of a serous orbital cyst, which occupied the inferior portion of the orbit and grew outward, pushing the lower lid before it.

CASE 2. *Clinical and Histological Examination.*—An infant of eleven months, well developed, without hereditary vices, had a normal right eye. The palpebral fissure of the left eye (Fig. 1) is lengthened to 3.5 *cm*, the outer canthus standing higher than the inner. The upper lid is sunken, the lower displaced forward and upward. The orbicularis functionates only in the upper lid. Lachrymal apparatus normal. Orbit distended at the cost of the inferior wall. The cyst extends from the inner canthus 1 *cm* beyond the external canthus, and has a shallow furrow on its surface. In the depth of the orbit is a body 1.5 *cm* in diameter covered with conjunctiva, and moving with the normal eye.

The cyst and rudimentary ball were extirpated, hardened in alcohol, and cut in serial sections in the antero-posterior direction of the orbit.

Microscopic.—The rudimentary ball which lay obliquely in the distended orbit, the optic nerve inward and the cornea outward, consists externally of a typical sclerotic coat 3 *mm* thick. Anteriorly it presents a cornea (Fig. 8, *a*), and this portion of the rudimentary ball most nearly resembles the normal. The opaque cornea, about 3 *mm* in diameter, has a modified epithelium, a stroma with parenchymatous infiltration, a typical membrane of Descemet, with a rudimentary ligamentum pectinatum and canal of Schlemm. The iris and ciliary body are fairly developed, the former being imperforate, and there is an anterior chamber (Fig. 8, *c*).

Inferiorly the sclerotic coat is open, and its fibres, continuing downward in parallel bundles from the entire extent of the ball, form a sac-like diverticulum, separated, however, from the orbital cyst by intervening fatty tissue. Where the scleral tissue passes over into the fibrous wall of the sac there is on each side in the entire length of the ball a mass of cartilage (see Figs. 2 and 3).

The posterior surface of the iris is covered with a single stratum of darkly pigmented epithelium—the pars ciliaris retinæ,—which also covers the projections and depressions of the ciliary region, and then gradually losing its pigment passes over into a typical unpigmented cylindrical epithelium covering the lateral and superior walls of the sac-like diverticulum, and then continues in a gliomatous cellular layer over the floor of the diverticulum.

The pigment epithelium of the posterior ciliary region is interrupted for a distance, and protruding through this break, yet for the most part lying in the sclera, is a rudimentary lens of hour-glass shape (Fig. 8, *f*).

As the sections pass back through the cornea the diverticulum beneath the ball does not appear, and its fibrous wall passes over into the fibrous outer wall of the orbital lower-lid cyst, it thus being evident that the outer wall of the cyst is the direct continuation of the sclerotic coat of the ball.

Now between the rudimentary ball and the cavity of the orbital lower-lid cyst we find an intercalated tissue, with many clefts and elevations, which represents an incomplete and anomalous development of the distal layer of the primary optic vesicle from which the retina normally arises (Fig. 6, about *h* and *k*). This layer of tissue rests in an inverted position on the intervening fibrous tracts. This intercalated tissue is, by the medium of the unpigmented cylindrical epithelium layer, directly continuous with the single stratum of pigment epithelium covering the ciliary region and lining the cavity of the ball, outside which pigment epithelium a typical choroid has developed.

The retinal element in this intercalated tissue, the outgrowth of the cyst wall, is inverted and altered, but easily recognizable (Fig. 7). The nerve-fibre layer rests on the fibrous supporting tracts, while the surface which normally rests on the pigment epithelium here lies free, bordering the sinuous cavities, and presenting a limitans beyond which here and there are seen rods and cones. The supporting framework of the optic nerve, including some nerve fibres, passes directly into the tissues resting on the fibrous tracts. The central portion of these fibrous tracts contains large nutrient blood-vessels.

The ciliary body at two points has pushed out and united forming a septum, which has become adherent to the distal wall of the ball, dividing its cavity into two. At some points the intercalated tissue rests on the posterior surface of this septum, being cut off altogether from the cavity of the ball (Fig. 6). At other points there is a small communication between the cavity of the ball and the clefts and spaces of the intercalated tissue. In other sections a communication may be found between the cavities of the intercalated tissue and the cyst cavity, indicating that all these cavities have freely communicated originally. The upper free portion of the cavity in the intercalated tissue continues into the coloboma of the nerve sheath. The intercalated tissue ends here and further inward appears shut in the solid fibrous cord connecting the scleral wall of the ball with the cyst wall, but projects out cone-shaped into the cyst cavity (Fig. 3, *h*).

The inner wall of the cyst has arisen from the retina. The pathological changes it presents may be referred to a diffuse interstitial retinal inflammation which has caused atrophy of all the nervous elements and proliferation of the supporting framework.

THE GENESIS OF THE CYSTS AND THE MICRO- OR ANOPHTHALMUS.

The cavity of the ball, which would otherwise have been open inferiorly, was found to be partially closed by the proliferation of the ciliary body. The spoon-shaped ball open inferiorly may all be considered as developed from the proximal layer of the primary optic vesicle. This layer produced first in the usual way the single stratum of pigment epithelium. The bordering mesoblast then proceeded to the formation of a choroid and a fairly typical sclera. Anteriorly there developed later the cornea and iris.

In this entire region, however, we find no products of the distal layer of the primary vesicle, which as is known produces the retina proper, the pars ciliaris retinæ, and the pars retinalis iridis. All these products are found, however, hanging to the rudiment of the ball, surrounded by a fibrous wall, which from the absence of a choroid has not developed into a typical sclera, and which also encloses a large orbital lower-lid cyst. The space in which these products of the distal layer are deposited is our intercalary space, and the products themselves make up our intercalated tissue.

In the ciliary region at the margin of the ball is a partially pigmented single stratum of cylindrical epithelium, which passes over into a higher unpigmented epithelium, which latter in its turn passes through a gliomatous tissue into the inverted and transformed retina. The single stratum of epithelium in its pigmented portion represents the pars retinalis iridis, and in its unpigmented portion the pars ciliaris retinæ.

These relations can only be explained by supposing the distal layer of the primary optic vesicle to have retained its original position. That no invagination occurred to form the secondary optic vesicle is shown by the absence of the lens from the interior of the ball. The scarcely recognizable rudiment of the lens has merely broken through the distal wall of the vesicle without invaginating it. Whether this has played any rôle in arresting the development of the eye is not clear.

With the development of the coats of the eye went hand in hand the secretion of the ocular fluid by the well developed retinal epithelium, and the current took the direction of least resistance, and passed into the folded products of the distal layer developing in the neighboring mesoblast, and distending them. And when a fibrous sheath had formed about these products, preventing their uniform distension, the weaker portions of this sheath yielded, and a large reservoir was formed, preventing the proper development of the inferior orbital wall and eventually pushing out into the lower lid. This increasing distension of the cyst affected the retinal lining and a diffuse inflammation occurred, with the results noted above.

The question now arises, can all the known cases of this malformation be explained in this manner. I believe that they may, with one modification consisting in the possibility of a partial involution of the primary optic vesicle.

Since we claim that this anomaly develops from the primary optic vesicle, we must have facts to show that there has been no involution of the primary vesicle, and that it has retained its original relation to the surrounding mesoblast. The simplest proof of this is the inverted position of the retina which has been found in every case examined. The lens or its rudiment cannot lie within the ball but must be in the connective-tissue coat, if there has been no involution of the vesicle. Nor can such a ball contain a retina in its normal relation to the pigment epithelium.

There are, however, cases of this malformation where the lens lies in the interior of the eye, andwhere there may perhaps be a retina of normal structure and position, the partially developed ball being in connection with cysts. In these cases we may suppose the distal wall of the primary vesicle to have become involuted in its anterior portion, forming a normal retina, while nearer the optic nerve it has not become involuted and this portion becomes distended, forming a cyst. In this manner we may explain the cases in which there is a cyst near the optic nerve of a ball that is fairly well developed.

In conclusion I would mention those malformations which may be called transition cases. These are such as are observed at a stage when the cyst has not reached any great development, and the lower lid is not protruding, and the cyst is found only when the orbital contents are examined anatomically. The cysts may be of any size. Usually, however, they are well marked at birth.

My thanks are due to Professor Schöbl, director of the Imperial Bohemian University Eye Clinic, for having granted me the clinical material used.

LITERATURE.

1. *Zeitschrift der h. k. Gesellschaft der Aerzte zu Wien*, 1858, p. 445, 446.

2. *Ibidem*, S. 446, 447.

3. *Wiener medicinische Presse*, 1885, S. 245, etc.

4. *Klinische Monatsbl. für Augenheilkunde*, xiv. Jahrg., 1876, S. 329, etc.

5. *Pamietnik drugiego zjazdu lekarzy i przyrodników polskich we Lwowie* (19.–24. Lipca 1875r). We Lwowie, 1876. (Torbiel oczodotowy wrodzony, potaczony z zupetnym brakiem gatkioczowéj.)

6. *Klin. Monatsbl. f. Augenheilkunde*, xv. Jahrg., 1877, S. 141.

7. *Ibidem*, S. 137–140.

8. *Bericht über die zwölfte Versammlung der ophthalmol. Gesellschaft*, Heidelberg, 1879, S. 105–114.

9. *Compte rendu du Congrès périod. internation. d'opht.*, Milan, 1880, and *Annales d'Oculistique*, Tome lxxxiv., S. 159.

10. *Przeglad lekarski*, Nr. 51, 1889.

11. *Szemészet*, 1878, Nr. 3; from Nagel's *Jahresbericht*, ix., S. 196.

12. *Aerzlicher Bericht des k. k. allgem. Krankenhauses zu Prag f. d. J.* 1879, S. 288. Prag, 1880.

13. *Gräfe-Sämisch*, Bd. vi., 1880, S. 686.

14. *Klin. Monatsbl. f. Augenheilkunde*, 1889, xviii. Jahrg., i. Abtheil., S. 154, etc.

15. "Zwei Fälle von Mikrophthalmus congen. nebst Bemerkungen über die cystoide Degeneration des fötalen Bulbus." *v. Gräfe's Archiv*, xxvi. Jahrg., i. Abtheil., S. 154, etc.

16. *Dieses Archiv*, Bd. xxiii.

17. *Klin. Monatsbl. f. Augenheilk.*, 1881, xiv. Jahrg., S. 423, etc.

18. *Annales d'Oculistique*, 1881, Tome lxxxvi., S. 144, etc.

19. "Casuistischer Beitrag zu d. Missbild. des Auges." *Diss.* Marburg, 1882.

20. *Revue générale d'Ophtalm.*, 1882, Nro. 2, S. 81, 82.

21. *Transactions of the Ophthalm. Soc. of the Unit. Kingdom*, vol. iv., S. 333, etc., 1884.

22. *Wiener medic. Presse*, 1885, Nro. 6.

23. *Ophthalmologische Mittheilungen*, ii. Abtheil., Wien, 1886.

24. *Wiener medicinische Blätter*, 1885, Nr. 51, 52, and 1886, Nro. 3.

25. "Beitrag zur Kenntniss der Colobomcysten." *Inaug.-Diss.*, Moskau, 1886.

26. *Progrès méd.*, xiv., 32, 1886, from Schmidt's *Jahrb.*, Bd. 212, S. 294.

27. *Archives d'Ophtalm.*, tome vii., S. 1–12.

28. *Recueil d'Ophtalm.*, 1888, S. 1, etc., from a review in *Archives d'Ophtalmologie*, Bd. viii., S. 178, etc.

29. *Wratsch*, 1888, Nro. 7, S. 134.

30. "Mikrophthalmus mit Cysten im unteren Augenlid." *Inaug.-Diss.*, 1888, Würzburg.

31. *The Royal London Ophth. Hosp. Rep.*, Part iv., Bd. xii., 1889. (Not accessible to me in the original.)

32. "Beitrag zu der Lehre von den angeborenen Cysten des unteren Augenlides mit Microphthalmus (Colobomcysten)." *Inaug.-Diss.*, 1890, Königsberg.

33. *Wiener klin. Wochenschrift*, No. 27, 1891.

34. *Archives d'Ophtalm.*, Mai-Juin, 1891.

35. Hirschberg's *Centralblatt f. pr. Aug.*, 1891., August.

Explanation of the Figures.

Fig. 1.—A sketch of the second case.

Fig. 2.—(*a*) scleral tissue, (*b*) the posterior layer of the choroid, (*c*) the obliquely cut optic nerve, (*d*) the posterior portion of the nerve-sheath coloboma, (*e*) the two cartilaginous masses, (*f*) the out-growth from the cyst wall.

Fig. 3.—(*a*) scleral tissue, (*b*) typical choroid, (*c*) oblique section of optic nerve, (*d*) nerve coloboma, (*e*) the two cartilaginous foci, (*f*) the cavity of the ball, (*g*) the septum between the nerve coloboma and the cavity of the ball, (*h*) the outgrowth from the cyst wall, (*i*) the opening of the cavities in the intercalated tissue into the large orbital lower-lid cyst, (*k*) single stratum of pigment epithelium.

Fig. 4.—A reticular portion of the inner layer of the cyst; (*a*) the inner surface, (*b*) the outer.

Fig. 5.—A portion of the inner layer of the cyst, with pencil-formed bundles of fibres; (*a*) the inner surface, (*b*) the outer.

Fig. 6.—A section through the rudiment of the ball, where the septum is united with the upper surface of the ball cavity, dividing it into two, and the intercalated tissue is apparently united with the entire posterior surface of the septum; (*a*) sclera, (*b*) suprachoroidea, (*c*) choroid, (*d*) pigment epithelium, (*e*) ciliary body, (*f*) ciliary muscle, (*g*) the two cartilaginous foci, (*h*) the third cartilaginous focus in the intercalary cavity, (*k*) the gland-like transverse sections of the folds of cylindrical cells in the intercalated tissue, (*l*) the same in longitudinal section, (*m*) a cavity containing pigment detritus, surrounded by a fine vitreous membrane.

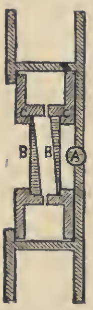
Fig. 7.—A portion of the perversely developed retina; (*a*) fibrous tract to which the retina is united by (*b*) the layer of hypertrophied Müller's fibres, (*c*) a fibro-cellular layer substituting the nerve-fibre layer, (*d*) remains of ganglion-cell layer, (*e*) inner reticular layer, (*f*) proliferated nuclear layers with (*g*) the included reticular layer replaced in the middle of the drawing by cells of the nuclear layers.

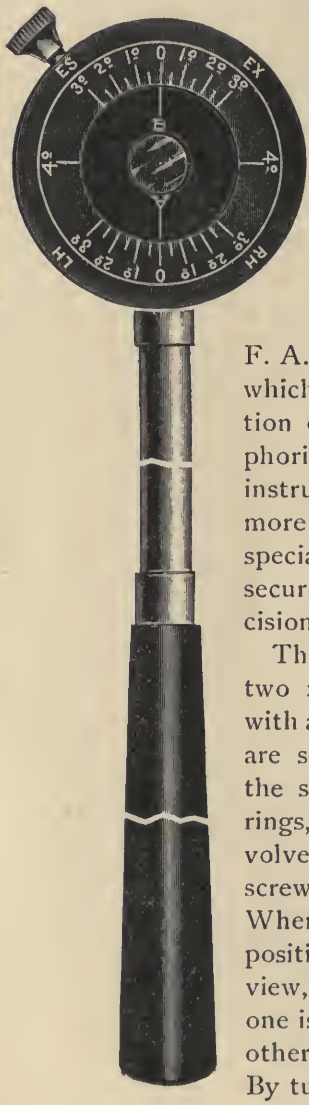
Fig. 8.—A section of the rudiment of the ball where it is completely separated from the orbital lower-lid cyst ; (*a*) the cornea, (*b*) the folds of conjunctiva, (*c*) the anterior chamber, (*d*) the remainder of the anterior portion of the ball cavity with the ciliary body, (*e*) the posterior ciliary region shows a cleft through which the rudimentary lens (*f*) protrudes, (*g*) two coloboma sacs adherent to the ball and lined with retinal elements, (*hh*) two contiguous cartilaginous foci.

Fig. 9.—The region of the rudimentary lens in Fig. 8 more magnified ; (*aa*) the ends of the perforated ciliary region, (*b*) the portion of the lens within covered with a typical capsule and epithelium, (*b′*) the portion of the lens in the scleral cleft, (*c*) longitudinal section of numerous folds and furrows of the ciliary region, covered with epithelium.

A NEW PHOROMETER.

By A. E. PRINCE, M.D., Springfield, Ill.





IN a paper read at the last meeting of the Ophthalmological Section of the American Medical Association, on "The Fourth Degree Prism in the Correction of Hyperphoria," it was suggested that an instrument was in process of manufacture by F. A. Hardy & Co., of Chicago, which would facilitate the detection of small degrees of hyperphoria. The completion of this instrument has demanded much more time than was anticipated, special tools being required to secure uniform mechanical precision.

This instrument consists of two 2-degree prisms, combined with a Maddox rod. The prisms are set as shown at "B B," in the sectional view, in revolving rings, "C C"; these rings revolve, by means of a thumb-screw, in opposite directions. When they are revolved to the position shown in the sectional view, in which the base of the one is opposite the apex of the other, they neutralize each other. By turning the thumb-screw, the bases of the prisms rotate toward each other with a refractive effect, increasing in amount as they rotate, until the bases are exactly opposite each other, when a total strength of 4 degrees is realized.

A Maddox rod, "A," is placed back of the prisms so that they rotate in front of it.

Placing the instrument, dial forward, before the patient's right eye, with the rod vertical, the image of a small gas-jet, viewed against a dark background, at a distance of fifteen feet or more, will be distorted into a horizontal band of light. Should an error of less than four degrees exist, rotation of the thumb-screw will effect a superposition of the images. The index will point to R. H., L. H., or O., denoting the degree of right or left hyperphoria, or the existence of neither.

Similarly in observations relative to esophoria or exophoria, the instrument is held before the right eye, with the rod placed horizontally. The thumb-screw is rotated until the vertical light band seems to coincide with the flame. The index will now point to Ex., Es., or O., denoting the degree of exophoria, esophoria, or the absence of both.

In case the deviating tendency be greater than four degrees, the character of the error will be indicated by the approximation of the images. A prism of 4 degrees is now placed in a trial cell, and if insufficient, is replaced by one of 8, 12, or more degrees, until one is found, which, with the aid of the phorometer, will secure the coincidence of the images. The degree indicated is now added to that of the prism employed.

To apply a control test, the instrument may now be held before the left eye and the dial readings reversed.

This phorometer has the advantages possessed by the Maddox rod over those instruments which depend on the principle of deflection. Two entirely dissimilar images are observed which have no tendency to blend, hence they can be approximated without risk of an effort being made to secure their superposition. In small degrees of deviation, more accurate discrimination is made than is the case when the images are of the same character, and hence, from necessity, removed to a greater or less distance from one another. The manifest error revealed by the rod more nearly corresponds with the total, though unfortunately, no method or remedy has been discovered to reach the maximum tendency by any single observation, as is the case in the mensuration of hypermetropia.

In addition, the following advantages of the phorometer over the simple Maddox rod are thought to exist:

First. It removes the possibility of preconceptions on the part of the patient.

Second. It avoids the necessity of an explanation of terms to the patient.

Third. It avoids the errors from fatigue due to delay, occasioned by the changing of prisms.

Fourth. It indicates the character of the heterophoria.

Fifth. It indicates the manifest quantity to a fraction of a degree.

Sixth. It saves the time of the observer.

Seventh. Its simplicity and inexpensiveness, together with the rapidity and accuracy with which the presence or absence of heterophoria is determined, render it of especial diagnostic value to the general practitioner or neurologist who recognizes the ætiological importance of muscular anomalies.

SYSTEMATIC REPORT ON THE PROGRESS OF OPHTHALMOLOGY DURING THE FOURTH QUARTER OF THE YEAR 1892;

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Geneva, and others.

Translated by Dr. Ward A. Holden.

Sections I.–V. Reviewed by Dr. St. BERNHEIMER.

I.—GENERAL OPHTHALMOLOGICAL LITERATURE.

TEXT-BOOKS, MONOGRAPHS, AND TREATISES ON GENERAL, BIBLIOGRAPHICAL, AND HISTORICAL SUBJECTS. STATISTICAL REPORTS.

335. Illinois Charitable Eye and Ear Infirmary. Eighteenth Report, 1891–92.

336. Albertotti. A French manuscript of the 17th century on the use of spectacles. *Man. della R. Acc. di Scienze, Lettere et Arti di Modena*, v., ix., series ii.

337. Rosmini. Report of the Ophthalmic Institute of Milan. *Boll. d'ocul.*, xiv.

338. Vossius, A. Text-book of ophthalmology, second enlarged and revised edition. Franz Deutike, Leipsic and Vienna, 1892.

339. v. Frimmel. Leonardo da Vinci's eye. *Repertor. f. Kunstwissenschaften*, xv., part 45, 1892.

The total number of eye patients treated in the Illinois Charitable Eye and Ear Infirmary (335), in two years, was 10,316; simple extraction was done 70 times, and Graefe's operation 129.

Albertotti (336) publishes the French translation of a treatise on the use of spectacles by the Spaniard, Daça de Valdes. The title of the original is : "Uso de los anteojos para todo genero de vistas." It was printed by Diego Perez, Seville, in the year 1623. Only seven copies of the book are in existence, six being in Spain or Portugal, and one in the British Museum. The text used by Albertotti is that of a manuscript French translation which is in the National Library in Paris. The book is of great historical value. The views of the author regarding the eye, vision, and loss of sight are those of Aristotle (the optic nerves unite in the pupil and through these the vital spirits are sent forth to objects which are to be seen . . . cataract covers the pupil, etc.).

In the second section of the book, definite rules are given for the selection of concave glasses for myopes, and for adapting convex glasses according to the years of old persons.

A remarkable fact is that the numbering of lenses as given by Daça de Valdes, and being then in use in Spain was according to the present dioptric system, many numbers differing only by a fraction from those now used. No. 1 was the weakest glass, No. 30 the strongest. No. 1 had a radius of curvature equal to the Spanish yard of that day which was 0.836 m, and thus was the equivalent of our 1.19 D. No. 30 was a segment of a sphere the size of the human eyeball and was equal to our 26 D.

Dantone.

Rosmini (337) in his report speaks of a case in which in the removal of an orbital tumor an abscess was opened which proceeded from the brain and which, as was shown at the autopsy, was caused by a large sarcoma. Dantone.

The new edition of Vossius' (338) book is considerably enlarged, and contains the latest investigations of others, and the author's investigations and clinical experience.

From a number of notes by Da Vinci on his vision, v. Frimmel (339) concludes that he was myopic. The stars appeared smaller to him when seen through a small opening than when seen with the naked eye. Two lights ½ ell apart at a distance of 200 ells were perceived as a single light. When observed through a pinhole, he recognized the two.

II.—GENERAL PATHOLOGY, DIAGNOSIS, AND THERAPEUTICS.

340. GILLET DE GRANDMONT. The microbic nature of the deep ophthalmias. *Arch. d'opht.*, xii., No. 10, p. 623.

341. TRUC. The evisceration of the ball in panophthalmitis. *Ann. d'ocul.*, cviii., p. 260.

342. LAGRANGE. The value of exenteration of the eyeball in respect to the wearing of an artificial eye. *Soc. de méd. et de chir. de Bordeaux*, July, 1892.

343. SNELLEN. Conservative therapeutics in ophthalmology. *Med. Tydschrift voor Geneeskunde*, part ii., 1892.

344. BARTKOWSKI. Contributions to the enucleation of the eye. Dissertation, Greifswald, 1889.

345. BEYER HILARIUS. Comparison between enucleation of the eye, exenteration, and excision of staphyloma, Dissertation, Greifswald, 1891.

346. v. MOLL. The local treatment of diseases of tissues that are not superficial. *Zehender's klin. Monatsbl.*, xxx., p. 329.

In a patient convalescent from typhoid fever suffering from iritis GILLET DE GRANDMONT (340) made cultures on agar-agar from the contents of the anterior chamber and obtained typhoid bacilli. Inoculations of the vitreous of a rabbit with the culture caused an inflammation which cleared up later. The rabbit which appeared to be well was killed, and the same bacillus was found in the intestines and the liver. In a second case of recurrent erysipelas with subsequent vitreous inflammation cultures on gelatine from the aqueous humor showed streptococci with the morphological character of those of erysipelas. In a third case opacities of the vitreous appeared suddenly two days after a miscarriage. Before a paracentesis had been made, the patient died of acute peritonitis. These internal ocular affections are due to infection from general disease. Paracentesis and culture experiments verify the diagnosis in doubtful cases.

v. MITTELSTÄDT.

In panophthalmitis TRUC (341) amputates the anterior segment of the ball ½ *mm* behind the corneal margin, and removes the contents of the ball with a blunt spoon. Any remaining pus or tissue is washed out with a Cenel syringe. A moist sublimate dressing is applied, and the wound irrigated twice daily. The operation may be done under cocaine anæsthesia; the stump so obtained gives a greater mobility to the artificial eye than the empty orbit. SULZER.

Whenever evisceration is possible LAGRANGE (342) prefers it to enucleation, since it leaves a stump that is indolent and permits greater mobility of the artificial eye. SULZER.

In the matter of conservative therapeutics SNELLEN (343) offers the following propositions: 1. An eye should not be removed for every ciliary injury. 2. In most cases of corneal ulcer the sharp spoon is of greater service than the cautery, since with it only the tissues diseased are removed. After scraping, the surface of the wound should be pencilled with tincture of iodine. 3. In glaucoma and cataract operations the iris should be spared as much as possible. WESTHOFF.

Being convinced that therapeutic agents applied to the surface have little effect on the deeper structures of the eye, and that general treatment is often insufficient, v. MOLL (346) treats the deeper tissues locally by injecting the remedy or by irrigation. In episcleritis irrigation with solutions of salicylate of soda are of benefit. In most cases of iritis and iridocyclitis and in diffuse keratitis, subconjunctival injections of sublimate ($\frac{3}{20}$ *mgr* with 5 *mgr* of cocaine) are useful. In scleritis and mild cases of diffuse keratitis injections of salicylate of soda (0.025 with 0.005 cocaine) are followed by good results.

III.—INSTRUMENTS AND REMEDIES.

347. CHIBRET. On antisepsis of the eye in general, and that by the cyanide of mercury in particular. *Arch. d'opht.*, xii., 7, p. 433.

348. MERGIER. A portable optometer for the rapid determination of ametropia and for measuring the visual acuity. *Ann. d'ocul.*, cviii., p. 351.

349. PRÉSAS. The application to physiological optical instruments of the decimal metric system in the divisions of the meridional quadrants. *Ann. d'ocul.*, cviii., p. 321.

350. DOR. On contact glasses. *Revue génér. d'opht.*, 1892, No. 11; and *Soc. des Sciences médicales de Lyon*, Séance du 2 Nov., 1892.

351. EATON. Practical application of the ophthalmometer of Javal-Schiötz. *Med. Record*, Nov., 1892.

352. Gavazzani. The action of cocaine on the retina and the optic nerve. *Boll. d'ocul.*, xiv., 23.

353. Geppner, Jr. Knapp's roller forceps in the treatment of trachoma. *Centralbl. f. prakt. Augenheilk.*, 1892, p. 208.

354. Haab. The use of very strong magnets for the removal of splinters of iron from the eye. *Report of the 22d Meeting of the German Ophth. Soc.*, p. 163.

355. Hoffmann. An aluminium trial-frame. *Ibid.*, p. 200.

356. Leber. Demonstration of apparatus. *Ibid.*, p. 187.

357. Schwartz. A new lid-holder. *Ibid.*, p. 187.

358. Weiss, L. A simple exophthalmometer. *Ibid.*, p. 212.

After four years' experience Chibret (347) recommends the use of a 10 per cent. solution of cyanide of mercury for sterilizing instruments. The instruments are left ten minutes in this solution without injury, and are then put into a 1:1500 solution. With the same solution, to which is added 1:7000 of chloride of sodium, the conjunctival sac is washed out and cleaned, the conjunctiva being no more irritated than by a 1:4500 solution of sublimate, while in antiseptic strength this solution is equal to a 1:1500 solution of sublimate. The anterior chamber is washed out with cyanide of mercury, 0.05; chloride of sodium, 7.00; aqua, 1000.00 The two eyes are bandaged for one day only, after which the unoperated eye is left open, the other being covered with a little cotton which is held in place by a smoked glass. The author offers nothing new as to the treatment of purulent processes. He does not favor the galvano-cautery, in place of which he used tincture of iodine for touching ulcers, and also pyoctanin, and for gonorrhœal ulcer nitrate of silver 5 per cent.

v. Mittelstädt.

Mergier (348) speaks of the errors in Donders' method of estimating visual acuity and ametropia. Besides the fundamental errors—estimating the ametropia from the visual acuity, and measuring the visual acuity after correction of the ametropia—he criticises the use of letters in estimating the ametropia, and the varying size of the visual angle in index and curvature anomalies. (Nevertheless, Donders' method is on account of its simplicity much preferable to the use of Mergier's optometer, although theoretically the latter may be free from objection. An objection common to all optometers is that the eye retains during the examination the accommodative condition which it has when the instrument is first looked through.—*Reviewer.*) Sulzer.

PRÉSAS (349) suggests that the perimeter arc be divided into 100° for each quadrant, and the horizontal projection of a hemisphere so divided to be used as a chart of the visual field. The circumference of the chart should also be divided into 400°. The 0°-point for each eye should lie on the nasal side as the intersection of the horizontal line with the circumference. For the right eye the numbers should run in the direction of the figures on the dial of a clock, for the left in the contrary direction, thus obtaining a symmetrical graduation of the chart for the two eyes.

DOR (350) has had good results with Sulzer's contact glass, particularly in cases of keratoconus. The glass is well borne by the patient. SULZER.

EATON (351) recommends the Javal-Schiötz ophthalmometer for the diagnosis of astigmatism, and reports several cases in which it was serviceable in solving difficult problems.

BURNETT.

GAVAZZANI (352) made retrobulbar and intraocular injections of cocaine in dogs, rabbits, and chickens, and found that, besides mydriasis and anæsthesia of the cornea and often of the conjunctiva, the retina showed a complete though transitory loss of function. All these symptoms disappeared within twelve to twenty-four hours. After intraocular injections symptoms of irritation came on which lasted longer. The quantity of cocaine used varied between $\frac{1}{10}$ and 1 *ccm* of 5 and 10 per cent. solutions. The author noticed also that in dogs besides the blindness a sort of intoxication came on, while the rabbits and chickens endeavored to hide themselves. DANTONE.

GEPPNER (353) treated more than sixty cases of trachoma with Knapp's roller forceps, and had only the best of results.

IV.—ANATOMY.

359. TERSON. A note on the acinous glands of the conjunctiva and on the orbito-palpebral lachrymal glands. *Arch. d'opht.*, xii., 12, p. 741.

360. GALLENGA. A contribution to the study of some congenital deformities of the lids: palpebral and superciliary coloboma and microblepharon. *Giorn. d. R. Accad. di Med. di Torino*, 1892, No. 7.

361. HESS. Contributions to the pathological anatomy of the congenital malformations of the eye. *Graefe's Archiv*, xxxviii., p. 92.

Terson (359) described the acinous glands of the conjunctiva of the lid and of the retrotarsal fold as regards their structure, arrangement, and relation to the palpebral and orbital lachrymal glands. He considers the conjunctiva as a whole, the retrotarsal folds and the lachrymal glands included, and shows how the acinous glands and lachrymal glands form a connected whole. In their anatomical and physiological relations and in their secretion the different sections of this glandular system are to be considered identical. As to the operative removal of the lachrymal glands, the author believes this to be possible as regards the orbital gland, but not so as regards the palpebral.

v. Mittelstädt.

Gallenga (360) described some very interesting cases of congenital anomalies of the lid. The detailed anatomical description of the lid and the statements as to the part played by the neighboring tissues in the abnormal developmental processes cannot be given in a short abstract, and the reader is referred to the original. Dantone.

Hess (361) described five cases of malformation of the eye in man, pig, and chick. Not one of the cases, according to the author's views, favored the inflammation theory, while some disproved it. In conclusion he described a pig-cyclops, the brain and eye of which were of particular interest.

V.—PHYSIOLOGY.

362. Bitzos. Scioscopy. Paris *Soc. scientifique*, 1891.

363. Osio. The circulation of the intraocular fluids; the mode of nutrition of the vitreous; critical review of recent experimental studies on the subject. *Ann. di Ottalm.*, xxi., 4–5, p. 247.

364. Faravelli. On apparent movements. *Ibid.*, xxi., 4–5, p. 297.

365. Faravelli. Time as a co-efficient to be introduced in the determination of vision. *Riv. gener. ital. di. clin. med.*, iv., 12–13.

366. Hegg. On color perimetry. *v. Graefe's Arch.*, xxxviii., 3, p. 145.

367. Ladd-Franklin, Christine. A new theory of light perception. *Zeitschrift f. Psych. and Phys. d. Sinnesorgane*, iv., 3, p. 211.

368. v. KÖNIG and DIETERICI. The primary perceptions in normal and abnormal color systems and their intensities in the spectrum. *Ibid.*, 241.

369. DIMMER. Contributions to ophthalmoscopy. *Graefe's Archiv*, xxxviii., 4, p. 29.

370. ZUCKERMANN. On the processes in the resorption of granular pigment injected into the anterior chamber. *Graefe's Archiv*, xxxviii., 3, p. 60.

BITZOS (362) gives an accurate description of the different shadows seen in scioscopy. He distinguishes a lateral, a paracentral, and a central shadow, which move directly or indirectly. He speaks of the influence of refraction, oblique incidence, and spherical aberration on the phenomena. SULZER.

In a concluding paper on the course of the fluids in the interior of the eye, OSIO (363) describes his own experiments and those of others, and in a *résumé* of twenty paragraphs gives briefly the present status of our knowledge of the subject.

DANTONE.

FARAVELLI (364) criticises the paper by Ferri on the apparent movement of objects with movements of the head while the eye fixes. Ferri substituted the arc for the chord in his geometrical demonstration. DANTONE.

The interesting investigations of KÖNIG and DIETERICI (368) cannot have justice done them in a brief review. Mono-, di-, and tri-chromatic color systems were tried on different persons with a color-mixing apparatus. The experimental and mathematical results support the Young-Helmholtz theory.

DIMMER (369) in the first part of his paper speaks of the location of opacities by comparison with the corneal reflex. An opacity lying in the centre of curvature of the cornea is always covered by the corneal reflex. An opacity lying in front of the centre of curvature moves with the observed eye and in a direction opposite to that of the observer's eye. The contrary is the case when the opacity lies behind the centre of curvature.

The margin of the lens appears dark in transmitted light, not on account of total reflection by the anterior surface of the lens of the light reflected from the fundus, but because this light is deflected by the portion of the lens near the equator, so that it does not enter the observer's eye. In incident light the margin of the lens appears as a bright gleaming line from the total reflection of the light at the posterior surface of the lens, when the lens is dislocated into the anterior chamber. The light must pass through the equator of the lens and the neighboring parts in order to be totally reflected at the other side of the equator.

When the lens is so dislocated that a portion of the equator of the lens is turned toward the equator, the margin in incident light appears white or yellow from the light reflected from the interior of the lens, and totally reflected at its margin.

ZUCKERMANN (370) concludes that injections of cinnabar and india ink into the anterior chamber should not be employed to prove the existence of lymph spaces in the iris tissue which are in communication with the anterior chamber: first, for the reason that a fibrinous precipitate is formed, which holds the pigment granules; and second, for the reason that the granules are taken up by leucocytes and transported to other parts. The fact that the granules, before they are enclosed in the fibrinous masses, are able to pass into the protoplasm of the corneal and iridic endothelium without pushing farther into the tissues of the iris, make it improbable that there are lymph channels in the iris which communicate with the anterior chamber.

Sections VI.—XI. Reviewed by DR. HORSTMANN.

VI.—ERRORS OF REFRACTION AND ACCOMMODATION.

371. NORSA. School myopia. *Igiene dell' Infancia*, Sept., 1892.

372. BAAS. On the anatomy and pathogenesis of myopia. *Arch. f. Augenheilk.*, xxvi., p. 33.

373. HEGG. A case of partial contraction of the ciliary muscle. *Journ. d'ocul. du Nord de la France*, Aug., 1892.

374. BISSEL. Observations with Javal's ophthalmometer. *Journ. Oph., Otol., and Laryngol*, Oct., 1892.

375. ROOSA. The prevalence of corneal astigmatism in eyes with normal acuity of vision and without asthenopia. *N. Y. Med. Record.*, Nov. 26, 1892.

376. DE SCHWEINITZ. Some notes on corneal astigmatism in 200 eyes measured with the ophthalmometer of Javal in comparison with the total subjective astigmatism after complete mydriasis. *Therapeutic Gazette*, Nov. 15, 1892.

377. DEYNARD. The value of Javal's ophthalmometer for correcting astigmatism where marked amblyopia was present. *The Post-Graduate*, Dec., 1892.

378. Knaeppler. Considerations on the treatment and the correction of astigmatism. *Arch. d'opht.*, xi., ii., p. 679.

379. Eaton. Some practical uses of the ophthalmometer of Javal-Schiötz. *Med. Record*, Nov. 12, 1892.

380. Percival. The relation of convergence to accommodation and its practical bearing. *Ophth. Rev.*, 1892, xi., p. 313.

Norsa (371) discusses in a popular way the school hygiene of the eyes and particularly with reference to the development of myopia. In the four classes of a school for teachers he found 69 per cent. of myopes, 65 per cent. in the first class and 71 per cent. in the fourth. Dantone.

Bissel (374) tabulates 500 eyes examined with the ophthalmometer, and whose refraction was otherwise tested. Of these 155 showed no astigmatism by the ophthalmometer or other test. In 110 all the tests showed the same astigmatism. In 192 the ophthalmometer showed more astigmatism (from 0.25 to 4 D) than the other tests, and in 43 it showed less; nearly all 0.25 D less, one 1, and one 1.25. Burnett.

Roosa (375) tabulates and analyzes 100 cases taken at random where there was no asthenopia, and visual acuteness was not less than $\frac{20}{20}$. Of these only 9 were found to be free from hypermetropia, as examined, generally, with the ophthalmoscope. There was no corneal astigmatism in 5 cases only. Corneal astigmatism in one eye only in 8 cases. The astigmatism was less than 0.5 D in 13 cases; it amounted to 0.5 D in twenty cases, and to 1 dioptry or more in 25, or one quarter of the whole. In all except the 9 cases there was hypermetropia of more than 1 D, sometimes as much as 3 D. In one case the corneal astigmatism amounted to 3 D. He infers from these examinations that the emmetropic eye is only an ideal and not a real condition.

Burnett.

In the analysis of De Schwienitz's (376) tables we find 150 eyes in which the corneal astigmatism was according to the rule. In 35 of these eyes the corneal and total astigmatism corresponded; in 6 the total was greater and in 109 it was less than the corneal, the average error being less than 0.5 D. In 21 eyes the corneal astigmatism was against the rule, and in 9 the corneal and total astigmatism were the same; in 12 it was different, the total being more in 8 and less in 4. Twenty-two eyes showed no astigmatism. In 12 of those a mydriatic showed total astigmatism 11 times against and once with the rule. The axis of the corneal and the total astigmatism was found to be different (5° to 10°) in only 11.1 per cent. of the eyes. BURNETT.

DEYNARD (377) reports a number of cases of defective vision in which the ophthalmometer revealed a high degree of corneal astigmatism as a cause. Most of the cases were improved by strong cylinders. BURNETT.

EATON (379) adds his testimony to the value of the ophthalmometer in the diagnosis of astigmatism, and relates several cases where its employment was most useful in solving difficult cases. BURNETT.

PERCIVAL (380) calls attention to the fact that in most of the cases in which the relation between convergence and accommodation is disturbed, the correcting glasses cause discomfort until the patient has become accustomed to the new conditions. Neurasthenic patients accustom themselves to such glasses only with difficulty. WERNER.

VII.—LIDS.

381. DESPAGNET. Treatment of blepharitis with sublimate in large doses. *Rec. d'opht.*, 1892, ii., p. 641.

382. BLOCK. Ætiology of chalazion. *Med. Tydschrift voor Geneeskunde*, ii., p. 974, 1892.

383. TAY. A case of symmetrical whitening of eyelashes and eyebrows in connection with sympathetic ophthalmia. *Trans. Ophth. Soc.*, xii., p. 32.

384. LAGRANGE. Blepharospasm. *Journ. de méd de Bordeaux*, 1892, 43, p. 478.

385. PALERMO. Primary tuberculosis of the tarsus. *Ann. di Ottalm.*, xxi., 6, p. 538.

386. DODD, H. Morphœa of right lower lid and cheek. *Trans. Ophth. Soc.*, xii., p. 31.

387. LAGRANGE. Note on a case of cornu cutaneum palpebral. *Annal. d'ocul.*, cviii., p. 403.

388. FUKALA. Treatment of blepharitis, ectropium after blepharitis, and senile or sarcomatous blepharitis. *Zeitschr. d. böhm. Aerzte.*, 1892, 3.

389. JULES. Case of congenital cleft of the upper eyelid, associated with accessory auricles and a probable dermoid cyst beneath the conjunctiva at the left outer canthus. *Trans. Ophth. Soc.*, xii., p. 171.

390. Kalt. The restoration of the lower lid destroyed in its entire thickness, at the expense of the upper lid. *Soc. d'opht. de Paris*, Nov. 8, 1892.

391. Rogman. Treatment of symblepharon ; new operative procedure. *Arch. d'opht.*, xii., 10, p. 627.

Despagnet (381) has seen obstinate cases of ulcerative blepharitis which resisted the usual methods of treatment, cured by the successive use of solutions of bichloride of increasing strength, beginning with 0.5 per cent. and going up to 6 per cent. A fourth of its volume of glycerine is added to the solution. Sulzer.

Block (382) examined microscopically several chalazia that had been removed in their entirety. He found no tubercle bacilli. The formations resembling giant cells, which he found, must be considered as regressive products of glandular acini. Tangl may have examined a tubercular infiltration of the lid, mistaking it for chalazion. Westhoff.

Tay's (383) patient, æt. twenty-eight, suffered from a sympathetic ophthalmia coming on thirty days after injury to the other eye. Three months later the eyelashes and eyebrows began to grow white. Werner.

Lagrange (384) cured a blepharospasm that would not yield to any other method of treatment, by pulling out the external nasal nerves. Sulzer.

Palermo (385) described in detail a tuberculosis of the tarsus which he had produced in the upper lid of a rabbit and of a guinea-pig by transplanting a bit of tubercular iris from another rabbit. Dantone.

In Dodd's (386) case there was no cause known to account for the patch of typical morphœa on the right lower lid and cheek. There was a scar from a wound at the external canthus. The disease began two years before, when the patient was aged fifteen. Werner.

Lagrange (387) describes as follows the horn 22 *mm* long which he examined. At the base were the normal constituents of the skin, hypertrophic papillæ covered with proliferated epithelial cells. Within the horny substance were masses of epithelial cells proceeding from the papillæ. The yellow and fibrillar horny substance was given a characteristic appearance by the presence of numerous spherical masses of epithelial cells, the horny substance consisting of transformed cells.

Fukala (388), in cases of senile or sarcomatous ectropium, excises the affected portion of the conjunctiva and then sutures the cut edge to the margin of the lids, with satisfactory results.

HERRNHEISER.

VIII.—LACHRYMAL APPARATUS.

392. SNELL. A case of symmetrical dacryo-adenitis. *Trans. Ophth. Soc.*, xii., p. 51.

393. SIMI. Scraping the lachrymal sac and duct. *Boll. d'ocul.*, xiv., 20.

394. HARTRIDGE. Double lachrymal fistula (probably congenital). *Trans. Ophth. Soc.*, xii., p. 172.

In SNELL'S (392) case the glandular enlargement, for which there was no assignable cause, subsided under use of potass. iodid. During the attack the secretion of tears was arrested.

WERNER.

In obstinate cases of tear-trouble SIMI (393) advises scraping the walls. For this purpose he used two sounds—one with a flattened, sharp-cornered edge, the other with a blunt point but with two sharp edges running longitudinally.

IX.—MUSCLES AND NERVES.

395. ASTENGO. The relation of the angle α to strabismus. *Ann. di Ottalm.*, xxi., 4–5, p. 307.

396. LAGLEYZE. Treatment of strabismus by shortening the recti muscles. *Arch. d'opht.*, xii., 11, p. 668.

397. AYRES, S. C. Glasses on a child two years old for convergent strabismus. *Amer. Journ. of Ophth.*, 1892, No. 11, p. 339.

398. SEGUIN. Eye-strain and its relations to cerebral hyperæmia, etc. *N. Y. Med. Journ.*, Dec. 3, 1892.

399. STÖVER. A case of bilateral paralysis of the ocular muscles. *Münch. med. Wochenschr.*, 1892, 48, p. 863.

400. MERCANTI. Tonic reflex spasm of the intrinsic muscles of the eye. *Annal. di Ottal.*, xxi., 4–5, p. 380.

401. A discussion on miner's nystagmus. *Brit. Med. Journ.*, 1892, p. 834.

402. DELEPINE. A case of aphasia and right hemiplegia with temporary spasmodic conjugate deviation of the eyes, excited by attempts to converge the eye strongly toward the middle line. *Brit. Med. Journ.*, Sept., 1892, p. 571.

Astengo (395) publishes several tables of Landolt, which give the relation of angle α in strabismus. From his measurements it is evident that there is no relation between the angle α and the angle of strabismus even in marked cases of squint. Angle α is more frequently positive than negative, and both conditions are more frequent in convergent than in divergent squint.

Dantone.

Lagleyze's (396) operation advances the tendon of the antagonistic muscle by folding it with a suture, which is drawn until the eyes stand straight and then knotted. The author believes that in this way the effect may be accurately guaged.

v. Mittelstädt.

Ayres (397) reports a case of convergent squint in a child of two years, for which he advised glasses (strength not stated), with the result of a complete cure of the strabismus. There was no difficulty in getting the child to wear them. Burnett.

Seguin (398) considers insufficiencies of the ocular muscles (supplied by the third and sixth pairs of nerves) from the standpoint of the neurologist. Symptomatically the differential diagnosis between a weakness of the third and sixth nerve is that in the former the pain or discomfort is referred most generally to the occiput or cervical region ; in the latter it is mostly confined to the head in the shape of a constriction-feeling, and there is a tendency to vertigo. In treatment directed to the eyes he recommends prisms and tenotomies. Burnett.

Mercanti (400), in a girl æt. twelve, who had suffered from a corneal inflammation, observed a severe blepharospasm and a contraction of the facial muscles of the same side. When the lids were forcibly opened the eyeball was seen to be abducted as in oculomotor paralysis. The blepharospasm was cured by suggestion, after which for some days the position of the eye alternated between abduction and adduction. The author considers these disturbances of the ocular movements as contractures of the muscles, which were brought about reflexly by the spasm of the orbicularis and facial muscles during the corneal inflammation and outlasted the primary affection. Dantone.

A Discussion on Miner's Nystagmus (401). Including :

A chapter in the early history of miner's nystagmus. By J. H. Bell.

A case of miner's nystagmus associated with double spasmodic torticollis. By W. T. Cocking.

Defective illumination as the cause of the nystagmus and other ocular disorders observed in miners. By J. Court.

The combined influence of attitude and deficient illumination. By H. B. Hewetson.

Fatigue of ocular muscles owing to the constrained attitude at work as the main cause of nystagmus. By Simeon Snell.

The importance of imperfect illumination as a factor in the production of nystagmus. By G. T. Thompson.

Attitude and deficient illumination both important factors in the production of miner's nystagmus. By Priestley Smith.

Considerable diversity of opinion existed as to the influences causing nystagmus, as is evident from the titles of the papers. It was proposed to appoint a committee to collect evidence.

WERNER.

DELEPINE'S (402) patient, a woman, æt. twenty-three, got an attack of complete right hemiplegia after rheumatic fever. On close convergence and during some fits conjugate deviation of the eyes, to the paralyzed side, took place. The visual acuteness and ophthalmoscopic conditions are not noted. There was extensive softening of the left motor area and typical descending degeneration. The deviation of the eyes is attributed by the author to inflammatory irritation of a centre implicated, but not destroyed, by disease, added to the stimulus caused by a volitional effort of convergence. WERNER.

X.—ORBIT AND NEIGHBORING CAVITIES.

403. BADUEL. On a case of orbital abscess from a lesion of the bone with secondary communication with the nasal cavity, and hydrops of the frontal sinus. *Ann. di Ottal.*, xxi., 4 and 5, p. 377.

404. BECCARIA. Two cases of abscess of the frontal sinus. *Ibid.*, p. 359.

405. DUJARDIN. A pipe-stem retained in the orbit and superior maxilla for four weeks without grave results. *Journ. des sciences méd. de Lille*, April 15, 1892.

406. JACCOUD. Treatment of exophthalmic goitre. *Gaz. des hôpitaux*, Nov., 1892.

407. SPICER. Orbital hemorrhages occurring in young children. *Trans. Ophth. Soc. Unit. Kingd.*, xii., p. 33.

408. JULER. Symmetrical tumors of both orbits—probably sarcomatous. *Ibid.*, p. 44.

409. **Beaumont.** Note of a case of exostosis of the orbit. *Ibid.*, p. 41.

410. **Wherry.** Specimen of orbital neuroma, about the size of a large walnut, which caused proptosis, and led to removal of the eye. *Ibid.*, p. 40.

411. **Rockliffe.** Monophthalmic proptosis. *Ibid.*, p. 38.

In probing an incised orbital abscess, **Baduel** (403) discovered an opening in the orbital wall, which led into the nose. When the cavity was syringed, not only pus came from the nose, but a gelatinous mass, which must have come from the frontal sinus. The disease was cured without injury to the eye or its functions. DANTONE.

Beccaria (404) described two cases of abscess of the frontal sinus. In both the diagnosis was easy, a fluctuating tumor being found above the inner commissure. Incision, drainage, and antiseptic washes led to a speedy recovery. DANTONE.

Jaccoud (406) for the treatment of Basedow's disease recommends hydro- or electro-therapy, together with the administration of arsenic (0.004–0.008 daily), or potas. brom: (2.00–4.00). Milk diet is of value in mild cases. SULZER.

Spicer's (407) three cases present the following features in common, viz.: they were under one year of age, were hand-fed, and were subject to sudden hemorrhages in the orbits; in two cases this followed a fit of crying, and in one there was catarrhal ophthalmia. The author regards the condition as infantile scurvy, and of the same nature as the cases described by Barlow as scurvy-rickets in the *Medico-Chirurg. Trans.*, vol. lxvi. Two of Spicer's cases had symptoms of rickets. WERNER.

Juler (408) records the case of a lady, æt. forty-five, in whom symmetrical tumors formed in each orbit, in the position of the lachrymal glands, leading to ptosis on both sides, and anæsthesia of left side of forehead. Examination of portion of the tumor indicated round and spindle-celled sarcoma. Several cases of bilateral lympho-sarcomata of the orbits were referred to in the discussion on this paper. WERNER.

Beaumont (409) removed an ivory exostosis of the orbital roof in a girl, æt. fourteen. The base was somewhat pedunculated. Drills and chisels were employed. The recovery was complete. WERNER.

Wherry's (410) patient, a man, æt. thirty-five, suffered from "neuralgic pains all over" and sleeplessness; the right eye began to protrude eight years before operation. The tumor, which was made up of fibrous tissue, had a nerve attached to it, presumably the third, from its size and resulting ptosis.

WERNER.

In ROCKLIFFE'S (411) case there were absolutely no symptoms to enable a diagnosis of the cause of proptosis to be made. Sixteen months later the protrusion was increased. WERNER.

XI.—CONJUNCTIVA, CORNEA, SCLERA, ANTERIOR CHAMBER.

412. MORAX. Bacteriological and clinical researches on catarrhal conjunctivitis. *Ann. d'ocul.*, cviii., p. 395.

413. PARYSCHEW. Intra-uterine infection with blennorrhœa. *Wratsch*, 1892, No. 47.

414. SCHNELLER. On the treatment of follicular conjunctivitis. *Graefe's Archiv*, xxxviii., 4, p. 52.

415. ADAMÜCK. The trachoma question again. *Wjestnik Ophth.*, 1892, No. 6, p. 514.

416. ABADIE. Surgical treatment of granular conjunctivitis. *Arch. d'opht.*, xii., 10, p. 626.

417. JITTA. Excision of the retrotarsal fold in trachoma. *Med. Tydschrift voor Geneeskunde*, part ii., p. 1092.

418. VAN MOLL. Metastatic conjunctivitis. *Ibid.*

419. HODGES, R. C. Unusual effect of jequirity in chronic trachoma. *Ophth. Record*, Dec., 1892.

420. MINOR, JAMES L. Unusual form of polypoid tumor of the conjunctiva. *Annals of Ophth. and Otol.*, Oct., 1892.

421. MICHEL, MIDDLETON. Plica circularis conjunctivæ in the negro. *Med. News*, Oct. 22, 1892.

422. TWEEDY. The physical factor in conical cornea. *Trans. Ophth. Soc. Unit. Kingd.*, xii., p. 67.

423. BRONNER. Case of recurrent keratitis superficialis punctata in which cocaine aggravated the symptoms. *Ibid.*, xii., p. 74.

424. COLLINS, E. T. Epithelial implantation cyst of cornea. *Ibid.*, xii., p. 64.

425. CROSS. Pemphigus of the conjunctiva. *Ibid.*, xii., p. 58.

426. DODD, H. W. Tubercular disease of the conjunctiva with infiltration of the cornea affecting the left eye. *Ibid.*, xii., p. 61.

427. Collins, E. T., and Cross. Two cases of epithelial implantation cyst in the anterior chamber after extraction of cataract. *Ibid.*, xii., p. 175.

428. Stephenson, S. Scarring of the conjunctiva from ophthalmia neonatorum; its characters, frequency, and associations. *Ibid.*, xii., p. 54.

429. Meyer, E. Note on a particular form of infectious keratitis. *Soc. d'opht. de Paris*, Nov. 8, 1892.

430. Fukala. A new method of treating corneal abscess. *Berliner klin. Wochenschr.*, 1892, No. 49.

431. Nuel. Filamentous keratitis. *Arch. d'opht.*, xii., 10, p. 593.

432. Hess. Clinical and experimental studies on the development of striped corneal opacity after cataract extraction. *Graefe's Archiv*, xxxviii., 4, p. 1.

433. Oliver. Symmetrically placed opacities of the cornea occurring in mother and son. *Ophth. Rev.*, xi., p. 349.

Morax (412) has found that the secretion of catarrhal conjunctivitis usually contains in pure culture the small bacillus described by Koch and Kartulis in Egypt and Weeks in New York. The clinical picture may vary with the virulence of the micro-organisms and may even simulate purulent conjunctivitis, in which case the bacteriological examination is of great importance. In the new-born the bacillus of conjunctival catarrh produces the clinical picture of ophthalmia neonatorum. It was found constantly in conjunctivitis catarrhalis, while it was not found once in seventy cases of conjunctivitis lachrymalis, phlyctenularis, or blepharo-conjunctivitis. In some cases it produces localized yellow swellings on the intensely injected conjunctiva bulbi, which are distinguished from the ordinary phlyctenulæ by the absence of a surrounding injection and by their localization.

Morax is the first that has been able to obtain a pure culture of the bacillus. The secretion used was obtained from a very severe case complicated with a corneal lesion. Agar and bouillon were used as culture media. The vitality of the cultures is slight. Inoculations of the pure cultures remain sterile, and even in the first culture the bacillus soon loses the ability to take the stain.

Sulzer.

Paryschew (413) reports the case of an eight months' fœtus born with a well-developed blennorrhœa and affected corneæ, the secretion containing gonococci. The amniotic fluid had escaped three days before birth. In Prof. Lebedew's clinic, where the case was observed, no prophylactic measures are taken except the repeated syringing of the genital passages with sublimate, $\frac{1}{2000}$ to $\frac{1}{3000}$. In 1,048 cases of labor only two cases of blennorrhœa occurred, of which the case reported was one.

HIRSCHMANN.

SCHNELLER (414) recommends, according to the severity of the case, sublimate, $\frac{1}{10,000}$; trichloride of iodine, $\frac{1}{5000}$; acetate of lead, excision of the retrotarsal folds with or without the adjacent conjunctiva, and portions of the tarsus. In pannus crassus he does peritomy.

ADAMÜCK (415) believes that follicular conjunctivitis and trachoma should be differentiated, and patients with the former disease isolated from trachoma patients, since they are predisposed to trachoma, but only acquire it by infection. In treatment the author prefers the copper stick. When the retrobulbar folds are severely affected he advises cutting them out with scissors. Trachoma may be due to different microbes, and this may account for its varying course. In some severe cases the excised retrotarsal folds show characteristic tubercle bacilli.

HIRSCHMANN.

ABADIE (416) finds that his surgical treatment of trachoma (deep scarifications and brushing with bichloride) is used with success by others, particularly in one district in Algiers, where ten per cent. of the population are blind from trachoma, and twenty-five to thirty per cent. of the military forces are incapacitated from this cause. He says that no complication is to be feared, and that the cure is rapid. New brushes should be thoroughly cleaned and sterilized in order to prevent animal infection.

v. MITTELSTÄDT.

JITTA (417) does not use sutures after excision of the retrotarsal folds, and he leaves the eyes open after the second day. In but two cases was the tarsus removed, and the result was bad. In 1,000 trachoma patients 75 cases were operated 114 times. The result was in 68 cases very favorable, 27 improved, 13 no improvement, 6 unknown. Too much of the conjunctiva should not be removed. In the following discussion it was said that very good results were obtained from the use of Knapp's roller forceps.

WESTHOFF.

VAN MOLL (418) believes that the conjunctiva may become inflamed secondarily from infection from within, and that a conjunctivitis may develop in gonorrhœa just as an arthritis does. He made culture in such a case and found the staphylococcus. A suspension of the culture was injected into the blood of a dog, and some days later a conjunctivitis developed, which showed in its secretion the microbes injected into the blood.

WESTHOFF.

The unusual features about HODGES' (419) employment of jequirity are that he employed it as an infusion dripped into the eye every day for several weeks with only a slight reaction, but with very beneficial results as regards the conjunctiva and cornea. BURNETT.

MINER (420) reports a case of long pedunculated polypus springing from the caruncle, which was found to have a cavity filled with pus and which communicated with the lachrymal sac.

BURNETT.

MICHEL (421) describes an elevation around the corneal base, yellowish-gray and pigmented and which seems to correspond perfectly with cases of circumcorneal hypertrophy of the conjunctiva, which the reviewer has seen in the negro, in whom this disease, in its bulbar aspect, is much more pronounced than in the white race. Michel regards such cases as congenital and not pathological, an opinion with which the reviewer is not inclined to agree, unless its congenital character could be made clear by an accurate history. Some cases of circumcorneal hypertrophy are very persistent and chronic and change little from year to year. BURNETT.

TWEEDY (422) attributes the occurrence of conical cornea to inherent weakness of its central portion owing to three factors in its development—viz.: 1. The separation of the epiblastic involution which forms the lens. 2. The intrusion of mesoblastic tissue in the homogeneous corneal tissue, which intrusion may not be complete in the centre. 3. The peripheral vascular distribution. WERNER.

In BRONNER'S (423) case the superficial punctate keratitis recurred for twenty-five years mostly in March and April. Patient was a man aged forty-eight. The attacks lasted from three to ten days. WERNER.

In COLLINS' (424) case, after an injury, anterior synechia followed, with tendency to bulging, which was not relieved by iridectomies. After excision it was discovered that there was a cyst, 9 *mm* by 5 *mm*, partly in the cornea and partly in the sclerotic;

its inner surface was lined by laminated epithelium, and there was a smaller similar cyst in the adherent iris.

WERNER.

CROSS (425) records the case of a woman æt. forty-seven who suffered from frequent attacks of pemphigus, chiefly affecting the throat and mouth. The conjunctiva in both eyes was shrunken ; a whitish membrane covered the inside of the lids and passed across the caruncles. The ocular conjunctiva was red and velvety, overlapping the cornea, whose margins were vascular.

WERNER.

DODD'S (426) patient, æt. fifteen, with evidence of general tubercular diathesis, exhibited on both lids of left eye granular atches of the shape of a cock's-comb as described by Arlt.

WERNER.

CROSS' (427) first patient had the eye enucleated, about a year and a half after a cataract extraction, for glaucoma, which began six months after removal of the cataract. A large cyst filled the anterior chamber and coloboma, its inner surface being lined by laminated epithelium. In the second case a similar cyst existed. Extraction had been performed ; the cornea became hazy, due probably to use of biniodide of mercury, and a thick opaque membrane filled the pupil. Glaucoma supervened.

WERNER.

STEPHENSON (428) divides the cicatricial changes into typical and atypical ; in the former a thin bluish scar covers the lower palpebral conjunctiva and upper fornix, the upper lid being free. As to frequency rural schools had 0.15 per cent. of scarred lids, urban schools 0.59 per cent., and pauper schools 1.88 per cent. The author did not see a single case of pyramidal cataract without scarring of the lids. WERNER.

MEYER (429) calls attention to the rare but characteristic cases of corneal affection in which a gray concentric opacity forms about a small, white, round, central subepithelial focus. The affection is extremely chronic and runs its course with irritation of the conjunctiva or vascularization of the cornea.

SULZER.

FUKALA (430) carefully cut off with iris scissors all the necrotic portion of the cornea in the neighborhood of the ulcer.

According to NUEL'S (431) investigations, the so-called filamentous keratitis is a disease of the corneal epithelium of hypertrophic nature. The filaments consist of an axial spirally twisted thread and a striped sheath. The corneal epithelium lengthens in a spindle form in rows, and at the intersection of two or more of these rows an elevation appears above the surface, first in the form of a cone and then as a long filament whose fibres still show epithelial nuclei. About this filament, which gives a keratin reaction, and, as Nuel believes, is an analogue of the corneal horn, are then deposited epithelial scales that have undergone a mucoid degeneration, wandering cells, and detritus from the cornea and the conjunctival sac. To demonstrate the origin of these filaments the superficial corneal lamellæ must be removed with them. By the movement of the lids the primarily vesicular elevations may become lengthened and form filaments. The author leaves it undecided as to whether such filaments arise from corneal ulcers ; they apparently do from injuries. Therapeutically good results were obtained by dropping a two-per-cent. solution of ammon. chloride into the eye six to ten times daily.

V. MITTELSTÄDT.

According to HESS (432) the common opinion that the so-called striped corneal opacity after cataract extraction is due to a swelling or loosening of the corneal substance is incorrect. The main anatomical change is a folding of the deeper portions of the cornea causing the layers to assume a wavy form. The cause of this folding is the difference in the tension in the vertical and the horizontal meridian of the cornea after the section.

Sections XII.—XXI. Reviewed by DR. P. SILEX, comprising Third and Fourth Quarters of 1892.

XII.—IRIS.

434. OEMISCH. On sarcoma of the iris. Inaug. Dissert., Halle 1892.

435. VAN DUYSE. Spontaneous recovery of iris tuberculosis ; attenuated tuberculosis of the iris. *Arch. d'opht.*, xii., 8, p. 478.

436. SNELLEN. Tuberculosis of the eye. *Med. Tydschrift voor Geneeskunde*, ii., 1892.

437. CANT. On the management of prolapse of the iris after simple cataract extraction. *Brit. Med. Journ.*, 1892, p. 834.

438. REDMOND. Tubercle of iris. *Trans. Ophth. Soc. Unit. King.*, xii., p. 85.

439. KNAGGS. Case of tuberculosis of the iris, the suspensory ligament, and the retina. *Ibid.*, p. 79.

OEMISCH (434) reported a case of leucosarcoma in a woman aged forty-two, and reviewed the eighteen cases reported since Fuchs' publication in 1882. The literature now contains reports of thirty-five carefully studied cases. It occurs mostly in women, and usually after the fortieth year. The point of origin is commonly the iris stroma. The prognosis is good. The treatment consists in the removal of the affected portion of the iris.

VAN DUYSE (435) after reporting a case of spontaneous cure of iris tuberculosis in a child aged twelve, discusses the different views as to the cause and prognosis of the disease, and accepts the opinion of Liebrecht and Leber that there is a benign form of iris tuberculosis. He rejects the view of Vossius, and comes to the conclusion that in an iris tuberculosis running a chronic course, which is not primary, no operative measures should be undertaken, and enucleation should be done only in the cases running a rapid course and when the eyeball is perforated.

v. MITTELSTÄDT.

SNELLEN (436) reports two cases of tuberculosis of the eye. One was a case of tuberculosis of the iris in a boy aged nine, affected also with white swellings, and the other a case of tuberculosis of the choroid. In the latter the appearance resembled that of glioma. The growth involved the sclera and the conjunctiva, and there was a tubercular ulcer of the conjunctiva. Tubercle bacilli were discovered.

CANT (437) operates in patient's own bed, without speculum. If prolapse occur he excises it under chloroform within twenty-four hours after extraction. WERNER.

REDMOND (438) succeeded in discovering a few bacilli in the diseased iris. The patient, aged ten, was in good health one and a half years after enucleation. WERNER.

In KNAGGS' (439) case the cells made their way through the suspensory ligament into the canal of Petit, but stopped abruptly at the hyaloid membrane. WERNER.

XIII.—CHOROID.

440. LAWFORD. Remarks on the pathology of some intra-ocular tumors. *Brit. Med. Journ*, 1892, p. 840.

441. MORTON, A. A group of cases of tubercles in the choroid, presenting some unusual features. *Ibid.*, 1892, p. 1190.

442. STORY. Detachment of choroidea. *Trans. Ophthal. Soc. Unit. King.*, xii., p. 157.

443. v. SCHRÖDER. A case of cure of a sarcoma in the orbit extending from the choroid. *Petersburg. med. Wochenschr.*, 1892.

444. LAGRANGE. On leucosarcoma of the choroid. *Arch. d'opht.*, xii., p. 1.

445. DARIER. Subconjunctival injections of bichloride in diseases of the choroid and retina. *Soc. franc. d'opht.*, May 5, 1892.

LAWFORD (440) is inclined to believe that many so-called sarcomata are in reality carcinomata arising in the glandular epithelium of the ciliary body. WERNER.

MORTON (441) records five cases of tubercle of choroid, all occurring in children suffering from general tuberculosis.

In Case I. there was a peripheral white patch slightly larger than the disc with a ring of dark pigment. The retina was adherent to the choroid and infiltrated by the tuberculous mass. In Case II. there were two pigmented patches almost equal in size to the disc and to its inner side. The tubercles were also pigmented in Case III. Case IV. exhibited patches of atrophied choroid along with a tubercular mass. In Case V. there were twenty-one tubercles in one eye, and seventeen in the other. WERNER.

In STORY'S (442) case the stroma and vessels of the choroid were distinctly visible under a detachment of the retina, both being visible in some places with +8 D lens. WERNER.

SCHRÖDER (443) in March, 1891, diagnosed sarcoma of the choroid in a woman aged twenty-eight, and, as appeared after the enucleation, the growth had extended back in the optic nerve and had formed numerous metastases in the orbit that could not be removed. A quantity of pure blue pyoktanin was strewed in the wound. No recurrence had taken place in 1892, and this was ascribed to the caustic effect of the pyoktanin.

LAGRANGE (444) reports two cases of leucosarcoma and comes to the following conclusions: Leucosarcoma stands, in relation to melanosarcoma as regards frequency, as 1:10, and is found more frequently in adults than in children. Half the cases are round-celled and half spindle-celled; and it is relatively less malignant than melanosarcoma. The unfavorable cases are almost all round-celled sarcomas. They quickly extend through the optic nerve into the orbit, and require exenteration of the orbit, while the spindle-celled sarcomas are cured by enucleating the eye. v. MITTELSTÄDT.

DARIER (445) has had good results with subconjunctival injections of bichloride in various macular affections, and in disseminate choroiditis. These injections are of service even in the cases where internal mercurial medication has been fruitless. Dufour, Abadie, Coppez, and Chibret have confirmed Darier's results, Despagnet and Vignes doubt them. SULZER.

XIV.—GLAUCOMA.

446. CRITCHETT. A case of double subacute glaucoma in a patient aged twenty-nine. *Trans. Ophth. Soc. Unit. King.*, xii., p. 86.

447. WEINBAUM. A case of hemorrhagic glaucoma with thrombosis of the central vein of the retina and ectropium uveale. *Graefe's Archiv*, xxxviii., 3, p. 191.

448. BOURGAN. On hemorrhagic glaucoma. *Thèse de Paris*, 1892.

449. FUKALA. Therapeutic notes. *Berliner klin. Wochenschr.*, 1892, p. 1248.

450. HOTZ. A case of so called hemorrhagic glaucoma. *The Ophth. Record*, Dec., 1892.

CRITCHETT'S (446) patient, a lady, received a severe shock from the death of a sister fifteen days before the onset of glaucoma. P. l. was doubtful; iridectomy was performed a fortnight later; ultimately V recovered to $\frac{10}{100}$, and remained so when last seen, *i. e.* seventeen years after operation.

WERNER.

In WEINBAUM'S (447) patient, æt. twenty-six, the vein was filled with an indifferent young granulation tissue. The retinal hemorrhages and the glaucoma probably resulted from this thrombus, of which the cause was unknown.

FUKALA (449) believes that when one eye is blind from glaucoma, the second should be operated before the outbreak of glaucoma.

HOTZ (450) substantiates the opinion that there is no real connection between the hemorrhages and the increase of tension in the so-called hemorrhagic glaucoma by a case in which one eye had been lost by glaucoma after two iridectomies, and there were subsequently hemorrhages in the other eye followed at an interval of six weeks by an outburst of glaucoma, which, however, was cured by an iridectomy. BURNETT.

XV.—SYMPATHETIC OPHTHALMIA.

451. Schirmer. On sympathetic inflammation without perforation of the eye primarily affected. *Report of Heidelberg Ophth. Soc.*, 1892, p. 449.

452. Schirmer. Clinical and pathological studies on the pathogenesis of sympathetic ophthalmia. *Graefe's Archiv*, xxxviii., 4, p. 95.

453. de Wecker. The prophylaxis of sympathetic ophthalmia. *Ann. d'ocul.*, cvii., p. 412.

454. de Wecker. Post-operative sympathetic ophthalmia. *Ibid.*, p. 81.

455. Valude. New methods of treating sympathetic ophthalmia. *France méd.*, 1892, 24, p. 378.

456. Baquis. Abadie's method of treating ophthalmia migratoria. *Ann. di Ottalm.*, xxi., 4–5, p. 300.

457. Dracoulidis. A late form of sympathetic ophthalmia. *Soc. d'opht. de Paris*, April 5, 1892.

Schirmer (451) distinguishes sharply between sympathetic irritation and inflammation. He endeavors to fix the pathogenesis of the latter by a critical study of clinical histories and by pathological investigations. He confirms the dictum of Schweigger that we have no sure criterion of the sympathetic nature of a given case. We must take into account the nature of the affection in the eye primarily affected, the nature of the affection in the second eye, and the interval between the two outbreaks. Of the diseases described as affecting the primary eye, he finds herpes zoster ophthalmicus and symblepharon not proven, sarcoma of the choroid and glioma of the retina not capable *per se* of causing sympathetic trouble, but only when complicated with irido-cyclitis, and cysticercus like herpes. Subconjunctival ruptures of the ball only cause sympathetic inflammation when an irido-cyclitis from ecto- or endo-genous infection has developed in the injured eye. Clean incarcerations and ruptures of iris tissue may at the most cause sympathetic irritation. Eyeballs containing bone are only dangerous when they show signs of internal inflammation. Spontaneous inflammations as the cause of sympathetic inflammation do not stand criticism. Sympathetic inflammation after operation is due to a uveal inflammation of microbic origin (traumatic uveitis plastica). Panophthalmitis does not dispose to sympathy ; if, however, an inflammation arises, the staphylococcus may not have been able to destroy Sattler's hypothetical organism of sympathetic ophthalmia. The gonococcus, the bacilli of tuberculosis and of lepra, and conjunctival irritation by an artificial eye do not cause sympathetic inflammation. The interval between the affection of the two eyes varies between three weeks and an unlimited period, but in the latter case the proof of an inflammation in the first eye is necessary. Even after enucleation, exenteration, neurotomy and optico-ciliary neurectomy, sympathetic inflammation may develop without a preceding irritation. The inflammation in the second eye is generally a uveitis or a papillo-retinitis, separate or combined. There is no sympathetic conjunctivitis, keratitis, cataract, detachment of retina, glaucoma, or optic-nerve atrophy. The isolated papillo-retinitis, caused probably by the action of the bacterial products from the primary eye, disappears immediately after enucleation and has a good prognosis. Sympathetic uveitis may be divided into iritis serosa plastica and irido-cyclitis plastica, with their transition forms. The prognosis is generally bad. The negative results of bacteriological examination of the first eye may possibly be due to the lack of suitable culture media and of stains for detecting the producer of the disease. Against the ciliary-nerve theory and for the bacterial, speak the possibility of propagation, the obstinate course with relapses, the absence of prodromal symptoms, the minimum interval of three weeks, the sympathetic inflammation after enucleation, and the fact that there must be always an infectious uveal disease. The specific micro-organism and the channels through which it passes are not yet known.

Pathological examinations of the first eye showed plastic iritis and cyclitis, and a nodular or more diffuse round-celled infiltration of the choroid.

DE WECKER'S (453) statistics show that during the period of linear extraction the cases of operative sympathetic inflammation were more frequent than during the period of flap extraction, which he has practised since 1875. He proposes the question of the relation of simple extraction to that with iridectomy in this respect, and requests his colleagues to assist in the solution by reporting their own observations. SULZER.

VALUDE (455) reports the clinical history of a patient in whom subconjunctival injections of bichloride and resection of the optic nerve were followed by but transient results, while enucleation succeeded in checking permanently the periodic attacks of sympathetic inflammation. SULZER.

BAQUIS (456) in a case of sympathetic ophthalmia made injections of sublimate (2 drops of a 1:500 solution) into the vitreous of the injured eye as proposed by Abadie, and was well satisfied with the results. An improvement in the second eye was noticed the following day. A week later the injection was repeated and all signs of irritation disappeared from both eyes, and the injured eye began to atrophy, but remained free from irritation and pain. DANTONE.

DRACOULIDIS (457) saw sympathetic ophthalmia break out twenty years after the original injury. The patient was a smith in whose eye a chip of iron had flown when he was twenty-three years old. After remaining free from irritation for twenty years the injured eye suddenly developed a severe irido-cyclitis which soon led to sympathetic ophthalmia. Examination of the injured eye showed that the foreign body was imbedded in a chalky capsule. SULZER.

XVI.—VITREOUS.

458. SGROSSO. Synchisis scintillans and spintheropia. *Rev. gén. d'ophth.*, 1892, No. 11.

459. BEAUMONT. Hemorrhage into the vitreous associated with epistaxis. *Ophth. Review*, ix., p. 352.

SGROSSO (458) saw synchisis scintillans in a man æt. thirty-two, an inhabitant of the Roman Campagna, after severe malarial attacks. Puncture of the anterior chamber relieved the entopic symptoms for a time. The aqueous which escaped contained crystals of cholesterin, tyrosin, margarin, phosphates and fatty detritus. An irido-cyclitis which developed later made enucleation necessary. Microscopic examination showed old inflammatory processes in the uveal tract, retina, optic nerve, and vitreous. SULZER.

BEAUMONT'S (459) patient was a young man æt. twenty-three, who was suffering from epistaxis every spring and summer, with headache. No constipation. WERNER.

XVII.—LENS.

460. COLLINS, E. T. On the minute anatomy of pyramidal cataract. *Trans. Ophth. Soc. Unit. King.*, xii., p. 89.

461. Wray. Ætiology, prognosis, and treatment of disseminated dot cataract. *Ibid.*, xii., p. 109.

462. Robinson. Spontaneous cure of cataract: second sight. *Brit. Med. Journal*, May, 1892, p. 1075.

463. Higgens, C. Case of spontaneous disappearance of cataract. *Trans. Ophth. Soc. Unit. King.*, xii., p. 107.

464. McCoy, Thos. F. A new shield for the protection of the eyes after cataract extraction. *Med. Record*, Dec. 3, 1892.

465. Mitvalski. On the spontaneous cure of senile cataract by means of intracapsular absorption, with remarks on Morgagnian cataract. *Centralbl. f. prakt. Augenheilk.*, xvi., p. 289.

466. Nicati. On the discovery of a method of extracting cataract capable of preventing incarceration and hernia of the iris or of diminishing their effects. *Arch. d'opht.*, xii., No. 12, p. 731.

467. Santos Fernandez. On the treatment of cataract in glaucomatous eyes. *Ann. d'ocul.*, cviii., p. 343.

468. Randolph. A series of fifty consecutive cataract operations. *Johns Hopkins Hospital Bulletin*, No. 20, March, 1892.

469. Korschenewski. Report on 1,500 cases of cataract extraction. *Medicinskoje Obosrenie*, 1892, No. 11.

470. de Wecker. What advancement remains to be realized in the extraction of cataract. *Arch. d'opht.*, xii., 6, p. 350.

471. Knapp. The methods and results of the simple extraction of cataract. *Journ. Amer. Med. Assoc.*, Sept. 3, 1892.

472. Landolt. The operation for cataract in our day. *Arch. d'opht.*, xii., pp. 402, 465, 529.

473. de Wecker. Simple extraction and combined extraction. *Ibid.*, xii., p. 657.

474. Nuël. On some corneal troubles following the extraction of cataract. *Soc. franç. d'opht.*, May 2, 1892.

475. Suarez de Mendoza. New points on suturing the cornea in the extraction of cataract. *Ibid.*, May 2, 1892.

476. Güllstrand. A case of lenticonus posterior. *Nord. Ophth. Tids.*, v., 1, Copenhagen.

477. Galezowski. On a new operative procedure for the extraction of secondary cataract. *Soc. franç. d'opht.*, May, 1892.

478. Chibret. On ouledialysis. *Soc. d'opht. de Paris*, Feb. 2, 1892.

From the examination of six cases of pyramidal cataract in different stages, Collins (460) finds that at first a mass of proliferated epithelial cells forms underneath the anterior capsule, which disturbs and breaks up some of the lens fibres in contact; later on the mass becomes condensed, homogeneous, and laminated, and contains a few cells; the hyaline capsule splits into two layers, enclosing this mass between them, the posterior layer being, according to the author, secreted by the cells lining it. He also supposes that the normal lens capsule is a product of cellular secretion. In all six cases there was corneal ulceration.

Werner.

Wray (461) noted four varieties of this form of congenital cataract, viz.: 1st, the simple form, small whitish or bluish dots, mostly peripheral; 2d, the above with opaque streaks; 3d, vacuoles, plus dots and streaks; 4th, degenerative changes in addition. In no case was the cataract absent in the patient's mother. Werner.

Robinson (462) states that he has seen three cases of spontaneous improvement in sight, due to softening and partial absorption of Morgagnian cataracts. Werner.

Higgens' (463) patient, æt. fifty-seven, had mature cataract for eighteen years, he then began to notice an improvement in the sight, and V became $= \frac{6}{36}$ with $+ 3\frac{1}{2}$-inch lens. There was some opaque membrane in the pupil. Werner.

McCoy's (464) shield consists of two cups made of light wire (not gauze), which are held over the eyes by means of tapes.

Burnett.

Mitvalski (465) adds two new cases to the eighteen previously reported of spontaneous cure of cataract. There is always a fluidification of the peripheric portions of the lens, or a transformation of the mature cataract into a Morgagnian. Following this the masses may decrease in volume, and the serous watery capsular fluid increase until, with the predominance of the latter, the lens gradually becomes transparent. This is particularly the case when both the fluid and the solid masses are absorbed.

After reporting an unfavorable case of simple extraction with an iris prolapse that was left, Nicati (446) discusses the different modifications of the operation of extraction.

When glaucoma develops in an eye with senile cataract, Santos Fernandez (467) advises that iridectomy be done. The extraction of the lens, in his opinion, does not influence the healing of the glaucoma. Sulzer.

The chief interest in RANDOLPH'S (468) series of operations lies in the fact that most of the operations were done in negro huts in the country or with other equally unfavorable conditions. In most cases an iridectomy was made. Two eyes were lost, one from hemorrhage and one from corneal suppuration.

BURNETT.

DE WECKER'S (470) letter to Sbordone, who defended simple extraction at the Congress in Palermo, is directed against the upholders of iridectomy. Iridectomy should have been discarded when the peripheric linear incision was given up. The incarcerations of iris and capsule in the latter operation are, in Dr. Wecker's opinion, far more dangerous than the iris prolapses occurring with simple extraction. In order to prevent this, a section should be found which does not gape too much, nor makes the coaptation of the margins difficult, and above all permits an easy extraction of the lens.

There are three sections to choose from: 1. The usual flap, the height of which is one third the diameter of the cornea, and the apex of which lies at the corneal margin; 2. A flap the base of which lies in the horizontal diameter of the cornea and its apex 2 *mm* from the middle of the upper corneal margin; and 3. A flap with its base 2 *mm* below the horizontal diameter and its apex at the junction of the middle and upper thirds of the vertical diameter. All of these sections have their advantages and their disadvantages in respect to the points under consideration. The second is adapted for large cataracts with a hard nucleus; the third would render difficult the extraction of the lens, but also the prolapse of the iris. A great step would be the discovery of a miotic more energetic than eserin which De. Wecker still uses although many have given it up. v. MITTELSTÄDT.

KNAPP'S (471) cases comprise 623 simple and 60 intercurrent combined extractions, made within six years. The principal points in the author's present procedure are the following: Preparatory operations are not done. He prefers to operate on an unripe lens than on one swollen by imbibition. The section is entirely in the cornea, everywhere in the same plane, and occupies nearly the entire upper half of the cornea; a small conjunctival flap is neither necessary nor disadvantageous. He opens the capsule at the periphery with a fine cutting cystitome which he has devised for this purpose, and he does not remove any part of the anterior capsule unless it is thickened. He does not wash out the anterior chamber nor does he go into the eye to bring out remains of cortex. The patient is sent from the operating chair to his bed with his eyes unbandaged, and if, when examined five to thirty minutes later, the iris is found to be in position, both eyes are closed with sterilized gauze cotton and isinglass plaster. When prolapse occurs within 24 hours, it is excised; when it appears later, it is left until the eye is entirely free from irritation. The author has found excision after the first day dangerous. In almost all cases he makes an early secondary discission with a knife-needle. He had an excellent result in 257 uncomplicated cases, a good result in 227, moderate in 28, a loss in 2, and prolapse of the iris in 19. BURNETT.

LANDOLT'S (472) interesting paper presents the following points: Cataract extraction is now much less dangerous than formerly, not on account of changes in the operative methods or a more accurate knowledge of the nature of cataract, but chiefly because of antisepsis and cocaine. It cannot be said, however, that all cataracts may be operated with the same facility and by the same process, for cataracts are too different in nature. The danger of extraction has uniformly decreased for all forms. For the simple mature senile cataract they are almost nil, so that some make the operation without iridectomy, and others allow the operated patients more liberty than before. Incomplete and complicated cataracts demand a careful selection of an operative method and careful watching during their course.

V. MITTELSTÄDT.

DE WECKER (473) criticises Landolt's views in regard to simple extraction as opposed to the combined operation, and believes that even skilled operators, if they know only the latter procedure, can give no judgment for or against the operation. He himself makes iridectomy in about one third of his cases, which, however, even when the operation has been normal, cannot prevent severe complications in the course of healing.

V. MITTELSTÄDT.

In a case with normal curvature of cornea and anterior surface of lens, GÜLLSTRAND (476) found by transmitted illumination a circular surface 3 *mm* in diameter, with a central dark patch, in the pupillary field. The refraction in the central round surface was highly myopic, while the periphery of the lens showed no myopia. On examining the third Purkinje image it was a normal inverted image in the periphery, which, as it neared the centre, suddenly became elongated and disappeared; he found also a small accessory image which, starting from the centre, moved toward the other image and met this at the moment when the latter vanished. There was therefore a transition zone, convex forward, between the central bulging and the normal peripheric portion of the posterior surface of the lens. SCHIÖTZ.

When a secondary operation is required after an extraction CHIBRET (478), seven to ten days after the extraction, opens the operation wound with a spatula in an extent of 4 *mm*, and extracts or divides the secondary cataract. SULZER.

XVIII.—RETINA AND FUNCTIONAL DISTURBANCES.

479. WIDMARK. On dazzling of the retina. *Nord. ophth. Tidschr.*, v., pt. ii., Kopenhagen, 1892. *N. Hygiea*, No. 6, Stockholm, 1892.

480. PANAS. Quinine amblyopia. *Rev. gén. de clinique*, 1892. No. 7.

481. LÈGUES. Hemophthalmia following the discharge of a cannon. *Arch. de méd. militaire*, Feb., 1892.

482. WILBRAND. A case of scotoma blindness and hemianopsia with autopsy. *Deutsche Zeitschr. f. Nervenheilk.*, ii., p. 361.

483. BURCHARDT. Amblyopia from non-use of the eyes, *Charité Annalen*, xvii., p. 474.

484. PLACZEK. Förster's displacement type, an objective symptom of traumatic neurosis. *Berl. klin. Wochenschr.*, 1892, No. 35, 36.

485. KÖNIG, W. On fatigue of the visual field and its relation to concentric contraction in diseases of the central nervous system. Leipsic, E. W. Vogel, 1892. (An exhaustive and interesting monograph, with an extensive bibliography.)

486. WADSINSKY. A case of gummous tumor of the sclera. *Wjest. Ophthal.*, 1892, No. 6.

487. HERRNHEISER. Contributions to the knowledge of metastatic inflammations of the eye and retinitis septica. *Zehender's klin. Monatsbl.*, xxx., p. 393.

488. WAGENMANN. Anatomical investigations on unilateral hemorrhagic retinitis with secondary glaucoma, also a report of the hypopyon keratitis observed with it. *Graefe's Archiv*, xxxviii., p. 213.

489. v. Hippel, E. A case of retinitis proliferans. *Zehender's klin. Monatsbl.*, xxx., p. 370.

490. Kern, R. On embolism of the central artery of the retina. *Inaug. Dissert.*, Zurich, 1892.

491. Weymann. The region of the macula lutea in ophthalmoscopy. *The Ophth. Record*, Dec., 1892.

492. Gould, G. M. Amblyopiatries. *Med. News*, Dec. 31, 1892.

493. Kingdon. A rare fatal disease of infancy, with symmetrical changes at the macula lutea. *Trans. Ophthal. Soc. Unit. King.*, xii., p. 126.

494. Priestley Smith. Changes in the retina due to long-continued lodgment of a metallic foreign body on its surface. *Ibid.*, xii., p. 191.

495. Beevor and Horsley. On a case of traumatic abscess in the neighborhood of the left angular gyrus, with right hemianopia (limited fields) and word blindness; treated by operation. *Ibid.*, xii., p. 204.

496. Collins, E. T. Intraocular neoplasm of doubtful nature and origin. *Ibid.*, xii., p. 165.

497. Spicer, W. H. Retinal vasculitis in inherited syphilis. *Ibid.*, xii., p. 116.

498. Stephenson, S. Unusual retinal reflex. *Ibid.*, xii., p. 115.

499. Tay, W. A fourth instance of symmetrical changes in the yellow-spot region of an infant, closely resembling those of embolism (see *Trans.*, vol. i., pl. iii.). *Ibid.*, xii., p. 125.

500. Stephenson, S. Angioid streaks in retina. *Ibid.*, xii., p. 140.

501. Gunn, R. M. Ophthalmoscopic evidence of (1) arterial changes, associated with chronic renal disease, and (2) of increased tension. *Ibid.*, xii., p. 124.

Widmark (479) reports a case of dazzling of the retina and reviews the eighteen cases reported since 1879. Usually a permanent positive scotoma appears, the visual acuity is more or less reduced, and in the macula there is in the beginning a light patch surrounded by a red or reddish-brown border, which later becomes darkly pigmented. In some cases all the symptoms disappear. The author has made experiments on animals and concludes that the changes in the retina caused by exposure to intense light are to be considered an œdema with necrosis of the nervous elements, not the consequence of a coagulation of albumen (Czerny and Deutschmann), but rather the results of chemical action, particularly of the shortest waves of light.

Schiötz.

Panas (480) reports the clinical history of a patient who became unconscious after the absorption of ten grains of sulphate of quinine, and after awaking was completely deaf and blind. Hearing returned on the following day, but the amblyopia, due to ischæmia of the retinal vessels, persisted for a long time. At the present time the patient still has hemeralopia. The author calls attention to the fact that the optic nerve when affected by quinine only regains its function slowly and incompletely, while the acoustic nerve recovers soon and completely. (The same as in many cases on record.—H. K.) Sulzer.

Lègues (481) examined an artilleryman, who experienced a shock and felt a pain in the right eye after the discharge of a 19 *cm* gun. The blind right eye showed extensive hemorrhage into the vitreous, and loss of the phosphenes with the exception of the nasal one. Sulzer.

Burchardt (483) reported a case of strabismus divergens with V = fingers at 12 *cm* Six days after the squint operation the vision was $\frac{3}{16}$.

Placzek (484), in all cases of concentric contraction of the visual field in traumatic neurosis, found the Förster displacement type well marked. (I have not.—*Reviewer.*)

Wadsinsky (486) saw a gummous tumor 1 *cm* broad at the lateral margin of the cornea, and a diffuse retinitis in the same eye. Under the use of mercurial enunctions and iodide of potassium the retinitis disappeared and the tumor was absorbed, leaving a pigmented depression. Hirschmann.

Herrnheiser (487) believes that metastatic retinitis is an inflammation of the retina, caused by micro-organisms, while retinitis septica belongs in the category with the retinal changes in certain general diseases—leucæmia, nephritis, etc.—the cause of which is a chemical change in the blood. The disease occurs not only after confinement, but also with pneumonia, peri- and endo-carditis, typhus, cerebro-spinal meningitis, purulent processes, otitis media, etc.

Wagenmann (488) from the examination of his first case concludes that an ophthalmoscopic picture of hemorrhagic infarcts, similar to that in which Michel found thrombosis of the central vein, may arise from multiple embolism of the retinal arteries. His second case furnishes the anatomical proof of Michel's second group of partial thrombosis of the central vein. His third case shows that a unilateral inflammation of the retinal vessels may develop, causing inflammation and hemorrhage, partly by injury to the vessel walls, partly by multiple arterial and venous thromboses without there being a thrombus of the central vein.

The case of HIPPEL (489) is noteworthy because of the absence of previous hemorrhage and on account of the peripheric location of the focus.

KERN (490) from a study of the literature and of the material in the Zurich clinic comes to the following conclusions: The majority of the cases described as embolism of the central artery are not embolisms, but probably a local disease of the central artery, such as atheroma, syphilis, endarteritis from Bright's disease or other dyscrasic conditions. When there is no organic heart lesion, syphilis should be suspected. In accordance with these views the general as well as local treatment should be employed.

WEYMANN (491) has made a careful study of the appearance of the macula and figures and describes its variations in the healthy eyes, which are five in number—ring-shaped, disc-like, oblong, crescentic, and an irregular form which is variable. The typical form he deems that with a central red dot with a circular band of whitish color. BURNETT.

GOULD (492) uses the term amblyopiatries to signify the therapeutics of amblyopia ascribed to "disuse," such as we ordinarily find in strabismus, etc.; and for the term *amblyopia ex anopsia* he uses the more correct term *argamblyopia*, and the treatment which he has instituted with marked success is: 1. Correction of the ametropia. 2. Reinstatement of muscular balance if imbalance exists. 3. Exercise. This latter consists in requiring the patient to use the amblyopic eye alone, and in the case of children paralyzing the accommodation of the better eye for weeks at a time. A number of cases are given illustrative of the method and its results. BURNETT.

KINGDON (493) records a case similar to those described by Warren Tay. On examination of the brain slight alterations in the cells of the cortical layers were all that was observed. In the retina the outer molecular layer seemed spaced out and enlarged as if by œdema. The author briefly reviewed cases described by Goldzieher, Magnus, Knapp, and others. WERNER.

In PRIESTLEY SMITH'S (494) case a fragment of bell metal was observed in the retina for fifteen months, the media remaining clear throughout. The metal was a mixture of copper, tin, and zinc. There was a scotoma in the field extending radially outwards from the spot corresponding to the site of the metal. $V = \frac{6}{18}$. Five months later it gravitated downwards producing a new scotoma, and leaving a gray opaque patch, with peripheral pigmentation, in its previous position. Thirteen months after a peculiar lustrous deposit was noticed over the vessels near the disc. WERNER.

In BEEVOR and HORSLEY'S (495) case, which was brought forward on account of peripheral contraction of the field in the eye opposite to the lesion of the angular gyrus, the evidence was not very conclusive. WERNER.

COLLINS' (496) case was probably a peculiar form of glioma (?) WERNER.

SPICER (497) records five cases of this disease, which is frequently associated with interstitial keratitis. The smallest veins are those chiefly affected, but the arteries also present the lateral white lines, increasing, as in the veins, towards the periphery, where at times the blood column disappears. There is generally some disturbance of the choroidal and retinal pigment in some cases resembling retinitis pigmentosa. The thickening of the vessels is due chiefly to a deposit under the endothelium of the inner coat, although there is some perivascular thickening with increase of nuclei. The changes are similar to those which occur in the cerebral vessels. WERNER.

498. This consisted in angular silvery streaks concentric with the disc, like a spider's web without radial fibres. WERNER.

STEPHENSON'S (500) patient had been a painter for three years, but never presented any toxic symptoms or signs. In both eyes dark reddish wavy anastomosing bands extended over the fundus; lying beneath the retinal vessels, there were also a few brilliant white metallic-looking spots, one large plaque and some hemorrhages. WERNER.

GUNN'S (501) patient exhibited an exceptionally bright light streak on the arteries which presented a somewhat metallic appearance; when they overlay a vein the latter was at times apparently empty and distended beyond. WERNER.

XIX.—OPTIC NERVE.

502. Bouveret. Optic neuritis in a case of tuberculosis of the cerebral peduncles. *Rev. de médecine*, Sept., 1892.

503. Darier. Subconjunctival injections of bichloride in certain affections of the optic nerve, neuritis, retrobulbar neuritis, amblyopia, etc. *Soc. d'opht. de Paris*, March, 1892.

504. Somya. A contribution to the study of hereditary retrobulbar neuritis. *Zehender's klin. Monatsbl.*, xxx., p. 256.

505. Somya. On partial atrophy of the optic nerve with hematemesis. *Centralbl. f. prakt. Augenheilk*, xvi., p. 225.

506. Galezowski. On the prodromal signs of tabic atrophy of the optic papillæ and on the syphilitic origin of the disease. *Rec. d'opht.*, No. 9, 1892.

507. Sulzer. On a primary tubular angio-sarcoma of the optic nerve. *Graefe's Archiv*, xxxviii., 3, p. 33.

508. Rohmer. A case of lymphangiectatic fibroma of the optic nerve. *Soc. franç. d'opht.*, May 2, 1892.

509. Sattler. On optic nerve tumors proper and their surgical treatment. *Beiträge zur Chirurgie*, 1892, Billroth Festschrift.

510. Lagrange. On the preservation of the eyeball in the extirpation of tumors of the optic nerve. *Cong. franç. de Chirurg*, iv., session April, 1892.

511. Taylor, S. J. Hereditary optic atrophy. *Trans. Ophth. Soc. Unit. Kingd.*, xii., p. 146.

512. Thompson, J. T. Case of Leber's hereditary optic atrophy. *Ibid.*, xii., p. 156.

513. Snell. Two cases of double optic neuritis occurring after influenza. *Ibid.*, xii., p. 162.

514. Drake-Brockman. A case of double optic neuritis dependent on spinal disease. *Brit. Med. Journ.*, July, 1892, p. 77.

515. Keyser. Glioma of the optic nerve—exophthalmus—enucleation. *Annals of Ophth. and Otol.*, Oct., 1892.

516. Wood, Casey A. The retrobulbar neuritis of young adults. *Ophth. Rec.*, June, 1892.

517. de Schweinitz. Embolism of the central artery of the retina, with a report of three cases. *Journ. Amer. Med. Assoc.*, Sept. 24, 1892.

518. Ayres, S. C. Embolism of the central artery or thrombosis (?), with report of a case. *Ibid.*, Sept. 17, 1892.

Bouveret (502) reports the following case. A tuberculous patient, æt. twenty-two, showed an incomplete left hemiplegia, inferior facial paralysis of the same side, and incomplete right ptosis. Paralysis or paresis of all the left ocular muscles. Beginning optic neuritis on both sides with decrease in visual acuity. Left monocular diplopia. Six months later the neuritis worse and retinal hemorrhages. Soon after complete right oculomotor paralysis, and after choreic movements complete paralysis of left, and right hemiplegia. Death in coma. At the autopsy a caseous focus was found at the foot of the left second frontal convolution, at the margin between the gray and the white substance. When the cerebral peduncles were divided, two tuberculous foci were found, each the size of a hazel-nut. One had nearly destroyed the right peduncle and extended into the lateral ventricle. It reached the floor of the aqueduct of Sylvius, the gray substance of which it had destroyed. The second focus lay in the left peduncle. Sulzer.

Darier (503) has obtained good results with subconjunctival injections of sublimate in cases of retrobulbar neuritis due to rheumatism, scarlatina, typhus, and influenza, and also in cases of central amblyopia of unknown origin. Sulzer.

Somya (504) found neuro-retinitis in a man aged nineteen. The mother, two brothers, and two nephews had also suffered from the same affection.

Galezowski (506) finds a larger percentage of syphilitics among his cases of tabic optic atrophy than any other observer. He ascribed the uselessness of specific treatment to the fact that severe symptoms appear only at an advanced stage of the disease.

Sulzer (507) reports a new case in a child, aged two and a half, and retains the name angio-sarcoma since the tumor originated in the perithelial cells of the vessels.

Rohmer (508) removed from a child aged three and a half a tumor of the optic nerve that had developed for three months. After cutting the tendon of the external rectus the nerve was cut through close to the sclera and the diseased portion separated from the healthy nerve. Recovery with slight atrophy of the retracted eyeball. The tumor was the size of a hazel-nut, and surrounded the nerve, whose nervous elements were destroyed by

pressure of a fibrous mass in the sheath and the interstitial tissue. The lymphatic system took part in the formation of the tumor, as was shown by numerous communicating lymph spaces. The tumor was benign, and after a year there had been no recurrence.
v. MITTELSTÄDT.

TAYLOR (511) records four cases, the patients being brothers. The family consisted of six sons and five daughters, the latter escaping. The personal and family history is given very fully. The ages of the patients varied from twenty-seven to fourteen years; they all smoked. In the two eldest the sight was better towards evening. WERNER.

DRAKE-BROCKMAN'S (514) patient, a boy æt. nineteen, died comatose from obscure disease of the spine opposite the third dorsal vertebra. There was double optic neuritis with brilliant metallic-like spots at macula, paralysis of right sixth nerve and ptosis, headache and vomiting and later on convulsions, spasms of the neck muscles. As there was no post-mortem allowed, meningitis of the base of the brain could not positively be excluded.
WERNER.

KEYSER'S (515) case was that of a feeble-minded girl of eight who had exophthalmus of both eyes, which had begun about four years ago. There was a papillitis in the right. The fundus of the left could not be seen because of the strong inward squint. The symptoms increasing the right eye was enucleated and the nerve found to be swollen. Some days later, paralysis on the right side set in, and she died soon after. The autopsy showed cerebral meningitis; right nerve markedly swollen, left nerve normal in orbit, but external to the chiasma there was a tumor three quarters of an inch in diameter, another small one sprang from the base near the pons and on the right side. On the left side in the substance of the middle lobe and anterior to the lateral ventricle there was a cyst 1¼ by 1 inch with a distinct wall and light amber contents. The tumors of the optic nerves were glioma or round-celled sarcoma. BURNETT.

WOOD (516) reports two cases of retrobulbar neuritis, one in a man and one in a woman. In both cases a permanent central scotoma for white and a larger scotoma for colors remained. The fundus and discs remained normal. He believes that these cases usually are cured. BURNETT.

The first case of DE SCHWEINITZ (517) is noteworthy since it was seen twenty minutes after the sudden attack of complete blindness came on. Even at so early a stage the œdema of the retina and the cherry-red spot at the macula were present. The vessels were all narrow. On the following day they had become larger, but in the course of some weeks they assumed the usual appearance seen in such cases. No perception of light. There was a marked mitral regurgitation and a systolic murmur. The two other cases were of the usual nature. BURNETT.

AYRES' (518) case was that of a man aged thirty-three, who awoke one morning to find himself blind in the left eye. In the inferior sector he could still count fingers at two feet. The retina presented the usual picture of embolism, and there was the cherry-red spot at the macula, but the vessels were of normal calibre and the disc normal. Four days after the attack the vision was entirely restored, but the œdema of the retina and the cherry-red spot remained a week or two longer. The condition of the heart was not noted. The patient was addicted to the use of tobacco and alcohol. BURNETT.

XX.—INJURIES, FOREIGN BODIES (PARASITES).

519. FERRON. A metallic particle in the iris. *Journ. de méd. de Bordeaux*, 1892, 79, p. 133.

520. DIANOUX. Treatment of injuries of the eye. *Soc. franç. d'opht.*, May 4, 1892.

521. FORGET. Microscopic examination of a stump after exenteration of the eye.

522. KALT. Two cases of death after enucleation. *Soc. franç. d'opht.*, May 5, 1892.

523. RAMPOLDI. Anchylostomum duodenale and retinal hemorrhages. *Ann. di Ottalm.*, xxi., 4–5, p. 357.

524. DOLINA. On the pathological anatomy of intraocular cysticercus. *Beiträge zur path. Anat. und allg. Path.*, v., p. 2.

525. GRAEFE, A. On intraocular cysticercus and its operative treatment. *Report of the German Society of Naturalists and Physicians*, Halle, 1891.

526. GRAEFE, A. Extraction of two cysticerci from one eye. *Zehender's klin. Monatsbl.*, xxx., p. 297.

527. FISCHER. The first discovery of anchylostomum duodenale in German miners, and the action of the anæmia caused by the parasite, on the eye. *Report of Heidelberg Ophth. Soc.*, 1892.

528. Roy. Report of a case of foreign body in the choroid and retina with retention of good vision. *Ophth. Record*, December, 1892.

529. Collins, E. T. On the pathological examination of three eyes lost from concussion. *Trans. Ophth. Soc. Unit. King.*, xii., p. 180.

530. Collins, E. T. Report of the examination of nine eyes in which a foreign body had remained imbedded for an unusually long time. *Ophth. Review*, xi., p. 135.

Ferron's (519) patient has a piece of iron in his iris, which had flown in from an explosion and caused no trouble. Sulzer.

Dianoux (520) recommends washing out the anterior chamber with sterilized water. Extensive cauterization of the wound when there is suppuration. His statistics show that even in cases which are apparently lost satisfactory results may be obtained.

Sulzer.

In Forget's (521) case the right eye was exenterated for secondary glaucoma, the sutures being put in before the hemorrhage was fully checked. The stump was enucleated nineteen months later for a neuritis in the other eye, whether sympathetic or not, being undetermined. The stump was flattened, showing numerous folds of the sclera, and measured 18 *mm* in æquatorial diameter and 10 *mm* in sagittal. The blood filling the cavity of the sclera was replaced for the most part by connective tissue in various stages of development. It is noteworthy that blood-vessels and nerves were present in the interior of the stump. The examination for micro-organisms was negative. The stump obtained by this method of operating is favorable for wearing an artificial eye at first, later it is not. v. Mittelstädt.

After a long series of successful enucleations for panophthalmitis, Kalt (522) lost two patients by meningitis. In the first case there was acute meningitis beginning with a chill twenty-four hours after the enucleation; in the second the first cerebral symptoms were observed twenty days after the enucleation. In the first case the panophthalmitis was due to an infected ulcer, in the second to traumatism. Sulzer.

Rampoldi (523), referring to Fischer's report of retinal hemorrhages in anchylostomum anæmia, calls attention to the fact that ten years ago he reported a similar case and later saw a second. In one case a convergent strabismus developed suddenly and disappeared at once after the use of antihelminthiacs. Dantone.

Dolina (524) states that in thirteen cases examined the retina was found to be detached and the choroid in a condition partly of plastic, partly of purulent inflammation. He found in his own case of cysticercus chalky masses, giant cells and bone. The original nest lay at the point where a posterior ciliary artery pierced the sclera and ended in the choroid. The parasite had probably entered the eye by this channel.

Graefe (525) among a number of cysticercus operations obtained perfect vision in three. He still recommends an æquatorial section of the sclera.

Roy (528) reports a case from the clinic of Sattler in Leipsic, in which a bit of steel remained imbedded in the choroid and retina, and became incapsulated with retention of V = $\frac{6}{6}$. There was at no time any considerable reaction. Burnett.

Collins (529) records three cases of injury in children, with only slight corneal abrasion. Case one had dilated pupil and iridodonesis, case two irregularity of pupil, and the iris had disappeared in the third case ; in the first two the lens was cataractous and displaced upwards, and the lig. pectinatum was torn, and the ciliary muscle split in the whole of its circumference, thus deepening the anterior chamber. In the last case the lig. pectinatum was completely torn, including the fibres giving origin to the ciliary muscle, which had retracted and drawn the iris back out of sight, when viewed from the front. In all cases the lens capsule was ruptured at the equator. Werner.

In Collins' (530) cases the shortest interval between the implantation of the foreign body and the enucleation of the eye was fourteen years. In seven instances the interval was more than twenty years, and in one case twenty-eight years. Enucleation was performed in three cases because the eye was blind and supposed to contain a foreign body, in five others the occurrence of pain necessitated removal, and in one case sympathetic ophthalmia occurring fifteen years after the injury. In all cases the foreign body was metallic, and situated four times in the lens, twice in the sclerotic, and twice in the vitreous, and once in a shell of bone on the choroid. The cases are tabulated.

Werner.

XXI.—OCULAR AFFECTIONS IN CONSTITUTIONAL DISEASE.

531. Hitzig. A contribution to brain surgery. *Berl. kl. Wochenschr.*, 1892, p. 713.

532. Bock. On artificially produced horizontal nystagmus, beginning with conjugate deviation. *Centralbl. f. Nervenheilk. und Psych.*, xv., p. 486.

533. Rendu. Nuclear ophthalmoplegia in the course of tabes. *Bullet. méd.*, Nov., 1892.

534. Christ. On nuclear ophthalmoplegia. *Deutsches Arch. f. klin. Medicin*, xlvi., parts 5 and 6.

535. Richet. Psychic blindness. *Soc. de biologie*, May 19, 1892. (Experiments on dogs.)

536. Galezowski. On alterations of the ciliary circle, and on the ophthalmoscopic examination of that region in constitutional diseases and in myopia. *Ann. d'ocul.*, cviii., p. 161.

537. Déjérine. On the localization of word blindness. *Soc. de biologie*, Feb. 27, 1892.

538. Boë. A case of rapidly increasing blindness. On the use of lactate of zinc. *Acad. de méd.*, May 3, 1892.

539. Müller, F. A contribution to the knowledge of word blindness. *Arch. f. Psychiat. u. Nervenkrank.*, xxiv., p. 856.

540. Freund, S. On optic hyperæsthesia of cerebral origin. *Centralbl. f. Neurol.*, xi., p. 530.

541. Parisotti. Comparative studies of the visual field in neuropathic and insane persons. *Boll. R. Accad. med. di Roma*, xviii., 5.

542. Ritzmann. Contributions to hypnotic suggestive therapy in ocular affections. *Correspondenzblatt für Schweitzer Aerzte*, xx., No. 3.

543. v. Hippel, E. On tumors of the hypophysis. *Virch. Archiv*, cxxvi.

544. Bidon. Hemianopsia, with hallucinations in the blind portion of the field. *Rev. de méd.*, Dec., 1891.

545. Coppez. A case of left homonymous hemiopia with complete paralysis of the left third nerve. *Soc. des sc. méd. et natur. de Bruxelles*, Oct. 3, 1891.

546. Pflüger. Bilateral temporal hemianopsia in a case of acromegaly. *Rev. génér. d'opht.*, 1892, 7, p. 295.

547. Abadie. Late manifestations of syphilis in the eye. Lack of success with general treatment. Value of local therapy. *Allg. med. Centralzeitung*, No. 65, p. 1314.

548. Galezowski. On the ophthalmoscopic examination of the ciliary circle in syphilis, tuberculosis, and gout. *Rec. d'opht.*, 1892, No. 6.

549. Graddy, L. Report of a case of blindness as a concomitant symptom of the grippe. Permanent anomaly of the visual fields. *Ophth. Rec.*, June, 1892.

550. Herrnheiser. Two cases of disease of the eye in icterus infectiosus. *Prager med. Wochenschr.*, 1892, No. 42.

551. Goldscheider. A case of acute polyneuritis with implication of the optic nerves. *Charité Ann.*, xvii., p. 163. (Neuro-retinitis ending in recovery.)

552. Courtaix. Clinical studies on the pathological relations between the eyes and the teeth. *Thèse de Paris*, 1892.

553. Fernandez and Madan. The hematozoa of Laveran in ophthalmic neuralgia. *Arch. d'opht.*, xii., 5, p. 266.

554. Juler. Persistent retinal hemorrhages in a case of diabetes. *Trans. Ophth. Soc. Unit. Kingd.*, xii., p. 137.

555. Alt. Some remarks on post-typhoid eye affections. *Amer. Jour. of Ophth.*, Nov., 1892.

556. Connor, Laertus. Heterophoria as a cause of acute rhinitis, loss of smell, and tinnitus. *Jour. Amer. Med. Assoc.*, Sept. 10, 1892.

Hitzig (531) reported two cases of circumscribed cerebral sarcoma with choked disc and concentric contraction of the visual fields, which were cured by extirpation of the tumor. At least the patients were alive seven months after the operation.

Bock (532) saw in patients and in colleagues after turning on the vertical axis, a nystagmus with occasionally also conjugate deviation of the eyes. When the individuals were turned to the right the first nystagmic movements were to the left, and *vice versa*, while the conjugate deviation corresponded to the direction of the turning.

Rendu (533) observed a bilateral chronic ophthalmoplegia externa, after which lancinating pain came on with a girdle feeling and vesical symptoms, and two years later the beginning of ataxy.

In Christ's (534) case a gliosarcoma of the pineal gland, the region of the corpora quadrigemina, and the posterior surroundings of the 3d ventricle, with hydrocephalus internus, caused a bilateral paresis of the 4th nerve by compressing the velum med.

ant. The disease began gradually with ptosis and accommodative disturbances, and developed into a complete ophthalmoplegia.

Repeated ophthalmoscopic examination of the ciliary region has shown GALEZOWSKI (536) that in various general diseases this region alone exhibits characteristic choroidal changes.

SULZER.

DÉJÉRINE'S (537) patient found in 1887 that he did not understand what he read. There was complete word blindness with right homonymous hemianopsia. The patient, a good musician, was unable to read music. Spontaneous writing and writing from dictation were normal, while copying was difficult. When the copy was removed the patient was unable to complete the word begun. Numbers were read easily, and reckoning, mental and written, was normal. Word deafness and disturbance of speech, hemiplegia, and hemianæsthesia were completely wanting. This condition lasted four years, in which time the patient learned the entire score of Sigurd and Ascanio by ear, and solved complicated problems, without being able to read the name of a single street in his walks. Sudden death after a short period of paraphasia and complete agraphia. *Autopsy :* Left hemisphere.—Fresh focus of softening in the inferior parietal lobe and the angular gyrus. The old lesions were found at the apex of the occipital lobe, at the base of the cuneus, the lobulus lingualis, and the lobulus pisiformis. All these points were atrophic, yellow, and hard, and Gratiolet's optic radiation appeared in Flechsig's section very atrophic. These lesions explained the hemianopsia, while to explain the word blindness we must assume an interruption of the association fibres between the memory centre for visual impressions of both hemispheres with the angular gyrus.

SULZER.

BOË (538) saw one eye become blind in a short time without any accompanying symptoms or any abnormal ophthalmoscopic appearance, while the vision of the other eye diminished to $\frac{1}{10}$. The second eye showed for some days a temporal hemianopsia. From the moment that lactate of zinc was given the loss of sight ceased to be progressive. Alb. v. Graefe reported an identical case in vol. iii., *Klin. Monatsbl.* SULZER.

MÜLLER'S (539) patient, aged fifty, had choked disc, severe headache, sight hemianopsia, twitching, and later paresis of the right half of the face and the right extremities. The autopsy showed a total right trigeminus paralysis caused by the compression and degeneration of the right ganglion of Gasser and of the trigeminus by extradural tumor masses. The entire left occipital lobe was destroyed by a tumor (Psammoma tuberosum). Besides this the posterior portion of the corpus callosum was softened and thus the association fibres interrupted which connect the right occipital region with the left and with the speech centre.

FREUND (540) in a case of traumatic neurosis found a hitherto unnoticed anomaly of the visual field consisting in a marked widening of the field for white and for colors. Green extended almost to the usual limit of the field for white.

PARISOTTI (541) examined the eyes of eighty-one patients with nervous or mental diseases, giving particular attention to the visual field. These observations are of importance because they do not agree with those made by Ottolenghi in Lombroso's clinic. Ottolenghi found that the visual field of epileptics, born criminals, and prostitutes showed a specific form with re-entrant angles outward and inward and particularly upward, a form not found in patients with other nervous or mental diseases. Parisotti found re-entrant angles in sixty-three of his cases, and also the form of field described in the diseases mentioned by Ottolenghi, but also in other nervous and mental diseases. The notched form of the field and the sinuous scotomata vary from time to time, since they depend on a periodic anæsthesia of the retina caused by circulatory disturbances. DANTONE.

RITZMANN (542) saw Prof. Forel cure an obstinate blepharospasm by repeated hypnosis, and an anæsthesia of the retina in two sittings.

BIDON (544) saw a patient, æt. fifty nine, suddenly attacked by vomiting and disturbance of speech. At the same time a left hemianopsia appeared with hallucinations in the blind half of the field. The hallucinations and the other symptoms disappeared, but the hemianopsia remained permanent.

ABADIE (547) recommends subconjunctival injections of sublimate (1 drop of a 0.1 % solution daily) as the best treatment for parenchymatous keratitis, and specific disseminate choroiditis.

GALEZOWSKI (548) uses a prism with the ophthalmoscope in order to make the peripheric portion of the fundus visible.

SULZER.

In GRADDY'S (549) patient, a woman in the third week of an attack of grippe, a sudden blindness came on, which varied from time to time, and finally ended in a left hemianopsia. The papillæ were not changed in appearance. The blindness doubtless depended upon an extra-cranial affection. BURNETT.

SANTOS FERNANDEZ and MADAN (553), making observations in malarial regions, found ciliary neuralgia to be of form of malarial attack. The typical form, without fever or other symptoms, is not so frequent as supposed. The examination of the blood according to Laveran's method confirms the diagnosis.

ALT (555) does not believe that the corneal abscesses seen in patients convalescent from typhoid fever are due to the specific poison of the fever, but to the generally reduced vitality of the patient. In one case of typhus which he saw there was an orbital abscess. BURNETT.

CONNOR (556) reported a case of exophoria of 12° which caused a rhinitis, anosmia, tinnitus, and symptoms of general nervous disturbance. The symptoms could not be referred to any other cause, and all vanished completely after the exophoria was corrected with prisms (!). BURNETT.

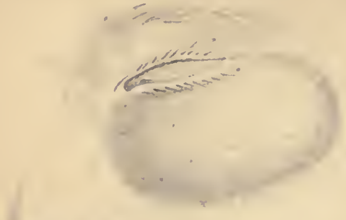
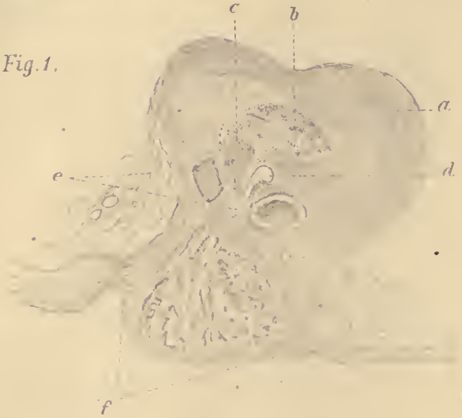


Fig. 1.



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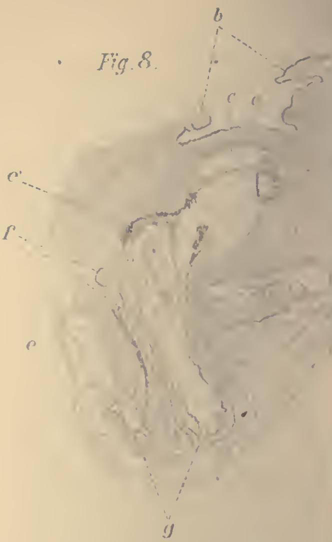

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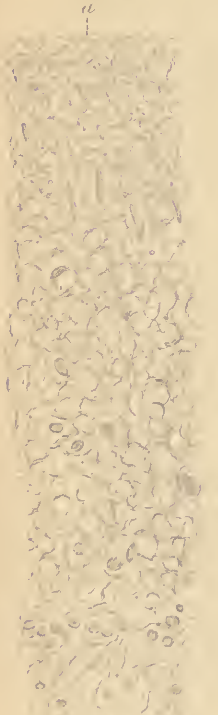

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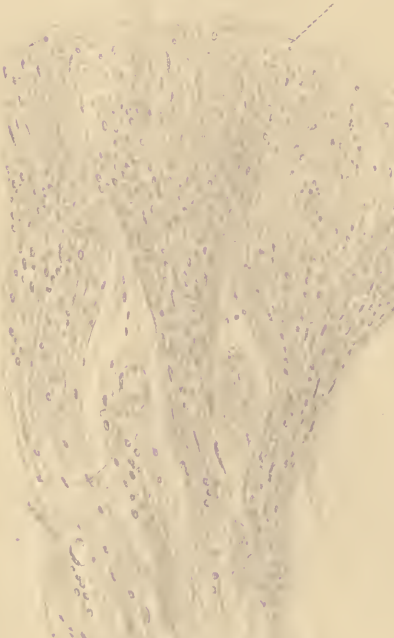

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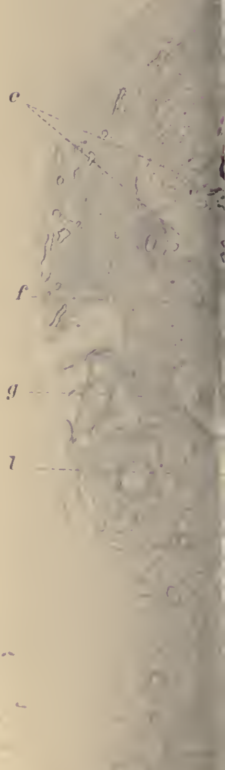
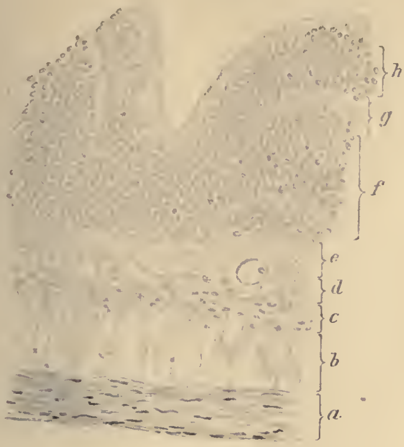


Fig. 6.

Fig. 7.



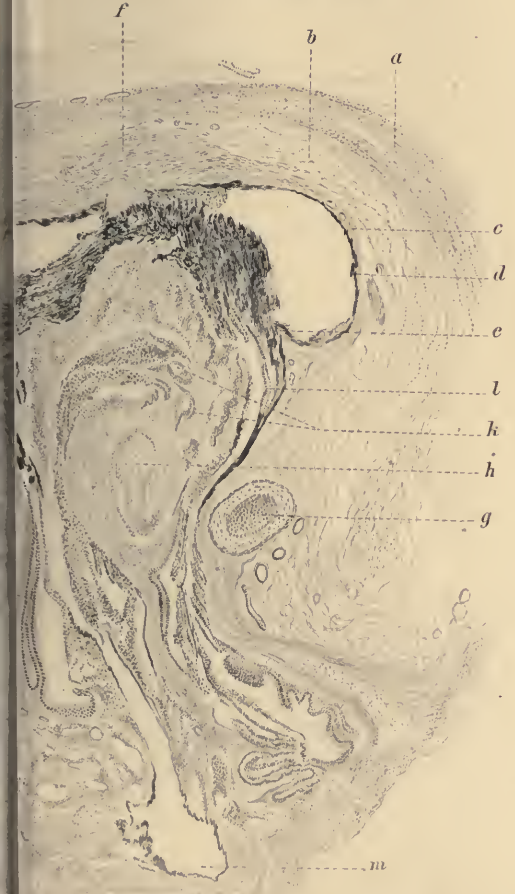


Fig. 9.

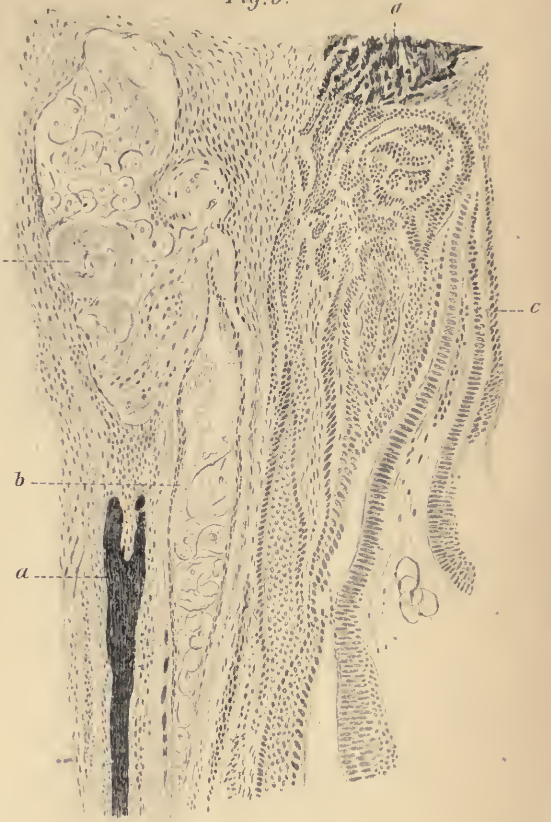
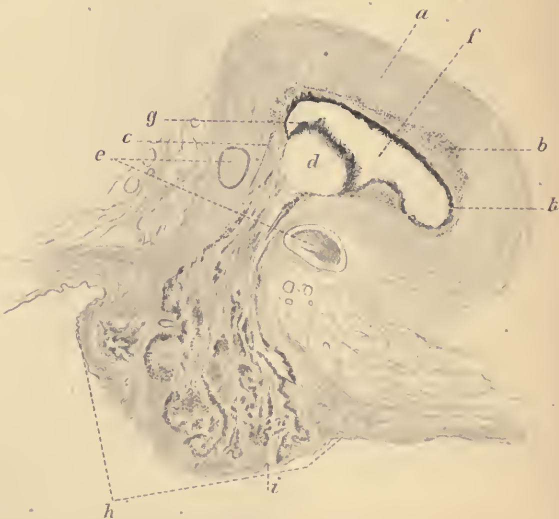


Fig. 3



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ARCHIVES OF OPHTHALMOLOGY.

ON THE PATHOLOGY OF HYPOPYON KERATITIS.[1]

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(*With one figure in the text.*)

THE following brief history of a case of hypopyon keratitis, with the results of the microscopical examination of the same is presented, inasmuch as the case, having occurred in a glaucomatous eye, seemed to present some features of interest, bearing on the pathology of the condition, especially on the origin of the pus in these cases.

The case was one coming under the observation of Dr. Gruening, and to him the writer is indebted for the history of the case, and for the specimen after enucleation.

E. S., female, æt. fifty-two, has been blind in the left eye two years, the cause of which was subsequently discovered to be glaucoma. The eyeball is stony hard. The eye first began to be inflamed three days ago. In the lower outer quadrant of the cornea, not far from the middle of the latter, is an infiltrated ulcer, about 3 *mm* in diameter, and situated about 2½ *mm* from the corneal margin. The ulcer is dug out with sharp edges. The anterior chamber is nearly half full of pus. The pupil which is widely dilated is not influenced by eserine. The patient suffers intense pain, and enucleation is advised by Dr. Gruening, to which the patient consented. Enucleation was done that afternoon, January 16, 1892.

The globe measured 22½ *mm* in the sagittal diameter, and 23 *mm* in the equatorial. The margins of the ulcer were thickly infiltrated, especially towards the adjacent corneal margin. The globe was fixed and hardened in Müller's fluid, then in alcohol, and mounted in photoxyline, and sections cut. It is hoped that the drawing submitted will explain the salient features of the case, and only a brief description of the sections will be given.

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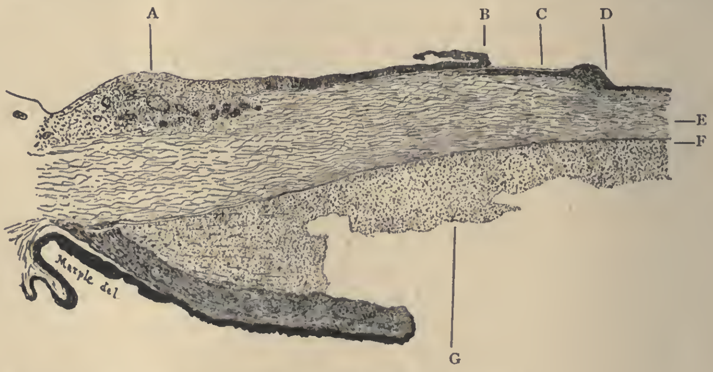
[1] Read before the section on Ophthalmology and Otology, N. Y. Academy of Medicine, May 15, 1893.

The *conjunctiva* is very greatly thickened especially at the corneal fold. *Cornea.* The epithelium is much thickened in the periphery, becoming thinner towards the ulcer, disappearing some distance from the border of the latter. The edges of the ulcer are sharp, the cut-off lamellæ being thickened, swollen, and necrotic, and the edges being elevated above the surrounding cornea. The corneal lamellæ in the vicinity of the ulcer are densely infiltrated with pus cells, and the infiltration is most dense in the anterior layers of the cornea, while it diminishes as Descemet's membrane is approached. The infiltration diminishes rapidly as the vicinity of the ulcer is left behind, especially as we go towards the middle of the cornea. At a distance in this direction of less than $\frac{1}{2}$ *mm* there is absolutely no trace of any infiltration. Towards the adjacent limbus, however, the infiltration extends much further, especially in the middle and anterior layers. In the vicinity of the border loop vessels, the infiltration is very abundant, and in the middle and anterior corneal lamellæ it can be traced from the ulcer up to these border loop vessels as is shown in the figure. At this distance from the ulcer, the writer



A. Thickened conjunctiva, with enlarged limbus vessels.
B. Epithelial layer, folded back.
C. Bowman's membrane.
D. Elevated edge of ulcer.
E. Cornea.
F. Descemet's membrane ; at its periphery the pigment cells are seen in front of Desc. memb.
G. Hypopyon.

has searched very carefully in the corneal layers near Descemet's membrane for any evidences of cell infiltration, but has been able to find only a few cells at varying distances from each other, just in front of Descemet's membrane, almost to the point where the pigment granules are found. Descemet's membrane is intact throughout, revealing no solution of continuity anywhere, or any evidence of cells penetrating it. A fact to which it is desired to call especial attention, and to the significance of which the writer will subsequently allude is, that pigment granules have migrated into the peripheral corneal lamellæ just in front of Descemet's membrane. [See figure.]

Anterior Chamber.—Much pus in the lower half, mingled, at the bottom especially, with a fibrinous interlacing network. In the upper part of the exudation, especially near the anterior surface of the iris is much albuminous substance. The iris is adherent to the cornea at the periphery for a considerable distance and the filtration spaces are obliterated. The iris is hyperæmic, infiltrated, and thickened. So thick is this cell infiltration in the anterior layers of the iris, that it is difficult, if not impossible, to say just which is exudation and which is infiltrated iris. Scattered throughout the exudation are numerous pigment granules. The ciliary body is hyperæmic and infiltrated. The endothelium lining Descemet's membrane, back of, and below the ulcer cannot be distinguished. Above towards the centre of the cornea, however, it soon becomes visible again. The lens has fallen out. In regard to the posterior half of the globe, it will only be noted that the optic nerve shows a very deep glaucomatous excavation.

In regard to the conclusions from the above, the following may be said: The condition corresponds with Leber's view of what is always found. He says that in hypopyon we seldom if ever have to do with a corneal abscess, and there was no evidence of any such condition in this case. Leber goes so far as to say that he has never met with a corneal abscess in any of the cases belonging in this category. As to the source of the pus in the anterior chamber, the fact that Descemet's membrane was intact throughout excludes (with a possible exception which will be subsequently noted) a corneal origin for the same. Furthermore such an origin is excluded from the fact that the iris angle is completely closed, and the iris at the periphery is adherent to

Descemet's membrane. Often an artificial separation takes place here in hardening and mounting these specimens. So that one is apt to be confronted with the picture of an apparently open filtration angle in an eye that was undoubtedly glaucomatous. Such a separation, indeed, took place in this specimen, but is very plainly here an artificial one. Oftentimes, however, it is not so easy to detect this, as in a case of hemorrhagic glaucoma recently examined by the writer, where at first sight it seemed as though we had to do with a widely open filtration angle. Looking more carefully, however, we see where in the contraction after enucleation the iris has pulled away from the cornea, but was in life really adherent for a considerable distance from the periphery. Priestley Smith, in his recently revised, most interesting work on the *Pathology and Treatment of Glaucoma*, calls especial attention to this fact, that the iris may be drawn back and stretched in the direction of its thickness, presenting a peculiar bend or notch on its anterior surface, just at the limit of the adhesion.

This closure of the filtration angle further excludes the vessels adjoining Fontana's spaces as the source of the pus in the anterior chamber, a source which was proven in most cases by Stromeyer and Hoffmann. In the writer's case, then, no other source for the pus is left except the iris or ciliary body. There was marked iritis, the anterior layers of the iris are so densely infiltrated that it is wellnigh impossible to distinguish the thickly infiltrated iris from the exudation of the hypopyon. Furthermore, scattered throughout the latter are numerous pigment granules, whose source was unmistakably from the iris.

In these cases of hypopyon keratitis there are always two problems for solution. First, what is the source of the pus in the anterior chamber, and secondly, of the pus in the cornea. In regard to the first there are three possible sources. First the iris. Arlt held that it came in all cases from the iris, and it is very probable that its source in very many cases is here. Occasionally we meet with hypopyon in iritis when the cornea is not at all involved, and in which the origin of the pus can only be the iris or vessels adjacent to Fontana's spaces. In most cases of hypopyon keratitis we have either marked iritis, or very great congestion of the iris, indicated by a sluggish pupil or discoloration of the iris. It is, however, objected that in some cases we meet with hypopyon before there is any evidence even of congestion of the iris. Here another source of the pus is to be found in the vessels adjacent to Fontana's spaces. In the experiments of Stromeyer and Hoffmann, by the use of the galvano-cautery, and the inoculation of infectious substances in the cornea of the rabbit, an abundant collection of pus was always found between the meshes of the ligamentum pectinatum, even where the adjacent iris was still free from purulent infiltration, and where there was as yet no hypopyon or turbidity of the aqueous. This infiltration existed in the whole circumference of the cornea, which excluded the possibility of its originating from a mere sinking of pus cells in the aqueous. It was on the contrary to be supposed that the pus cells migrated from the vessels of the tissues surrounding the iris angle, thence into Fontana's spaces, and thence into the aqueous. There can then be no doubt that in most cases, either the iris, or the vessels adjacent to Fontana's spaces, or both, contribute the pus of the hypopyon.

Now a few words as to the pus reaching the anterior chamber from the cornea. It is generally accepted at present that this does not take place through a fistulous opening of Descemet's membrane. So far as the writer is aware, all specimens belonging to this category have shown microscopically a perfectly intact Descemet's membrane, unless the eyeball has previously been perforated through the ulcer with escape of aqueous, synechiæ, etc. Weber, of course, claimed to have demonstrated the existence of such a fistulous opening through Descemet's membrane—by means of a probe. But rude manipulation of a probe in case of a deep ulcer could easily form an artificial opening where one did not previously exist. The lines leading downwards from the ulcer to the periphery and which were formerly thought to be in the corneal lamellæ, and to be the paths in which the pus gravitated into the anterior chamber, have been proven to be on the posterior surface of the cornea. This proof was furnished by the careful use of the loupe, and further by the disappearance of many of these lines, when by puncture of the cornea the aqueous has been evacuated. With the gush of the aqueous many of these deposits on the posterior surface of the cornea have been washed out with the aqueous. Anatomically the interlacing arrangement of the corneal lamellæ would furthermore hinder the gravitation of any considerable quantity of pus except between Descemet's membrane and the corneal tissue. A further argument against the supposition that the pus of the hypopyon originates from the cornea is that bacteriological examination *in the early stages* almost never reveals microbes in the hypopyon, while they are, of course, present from the commencement in the corneal ulcer and the adjacent lamellæ. Leber in many cases, after carefully cleansing the eye and conjunctival sac with sublimate solution 1:5000, cauterized the whole ulcer thoroughly with the galvano-cautery point, thus completely sterilizing the parts. He then divided the bottom of the ulcer and transferred a bit of the extruding purulent mass of the hypopyon to agar or gelatine by means of a sterilized platinum wire. Where strict precautions were taken to prevent the access of extraneous germs the results of his experiments in the early stages were invariably negative. With this, clinical observation agrees—viz., that if we succeed in cauterizing with the actual cautery the bottom of the ulcer completely, so as to destroy all microbes, the process quickly comes to an end, even where the hypopyon is not emptied, which would hardly occur if microbes were much mixed with the pus remaining in the anterior chamber. In the writer's case, no microbes were found in the hypopyon, but as the specimen was not treated especially in its preparation for the study of micro-organisms, no especial emphasis is laid upon the failure to discover them. Furthermore, there was much pigment scattered through the hypopyon. This pigment was often in the shape of very fine granules, which were often arranged in little groups of three and four very close to each other, so as to present an appearance surprisingly like cocci, especially as the stain used was methyl-blue, but careful observers agreed with the writer that they were pigment granules and not cocci.

Marie Bokowa, under Horner's direction, made some experiments on the eyes of rabbits and guinea-pigs from which Horner concluded that the pus cells originate from the cornea, but reached the anterior chamber in another manner than by gravitating down through the corneal lamellæ. As has long been observed, in the early stages of many ulcers of the cornea, a coagulum or circumscribed deposit of fibrin containing pus cells is formed on the posterior surface of the cornea just posterior to the seat of the ulcer. Bokowa removed the corneal lamellæ in the centre of the cornea of the rabbit to a considerable depth, and then cauterized this spot with nitrate of silver stick. The cauterized spot was also brushed freely with cinnabar. On enucleating the eyes afterwards, at intervals varying from three hours to several days, this exudate on the back of the cornea was always found. In an eye removed twenty-four hours afterwards, granules of reduced silver were found in the exudate on Descemet's membrane. Descemet's membrane was stained a deep black. Horner held that the presence of the reduced silver in the exudate indicated the presence of stomata in Descemet's membrane which allowed the transit of pus cells, which, reaching the anterior chamber, descended along the posterior surface of the cornea, furnishing the so-called "gravitation lines" and the hypopyon, apparently a very plausible theory. But in the first place, as Leber objected, the presence of reduced silver in the anterior chamber does not at all justify the inference as to the existence of stomata in Descemet's membrane. The separation of the silver takes place just as in silvering of the dead cornea, where the silver dissolved in the sodium chloride or the silver albuminate spreads through the tissues by diffusion and in contact with reducing organic substances is separated in the form of silver granules. Furthermore stomata in Descemet's membrane have never been demonstrated. Again a significant fact in Bokowa's experiments is that she never found the cinnabar (which was so freely brushed into the cauterized spot), back of Descemet's membrane. If the stomata allowed the passage of the silver granules, what prevented the transit of the cinnabar grains. The only inference remains that Horner's supposition is not justified by the conditions found.

But one fact which Bokowa observed deserves especial attention. In an eye enucleated only three hours after she had cauterized the middle of the cornea, she found this exudation on Descemet's membrane. It was limited to the area just back of the cauterized spot and contained many pus cells. The endothelium showed no changes, there were no pus cells or exudation anywhere else on Descemet's membrane, nor did the microscope reveal their presence in the aqueous. Whence came these pus cells? Leber held that the inflammatory agents exercised an attraction upon the migrating leucocytes, which resulted in these latter proceeding towards the seat of the injury from the corneal borders on all sides, in the substance of the cornea, on its posterior surface and from the aqueous. To this Horner objected inasmuch as he had been able to convince himself by day-to-day examination with the loupe in cases of corneal ulcer in man, that the purulent exudation sinks on the posterior surface of the cornea, from the seat of the ulcer in the shape of lines or streaks, before any appear at the periphery, or before there is a sign of any hypopyon, an observation which many other careful clinicians have made. Although Leber thought that nevertheless a migration towards the middle of the cornea might take place, which could only be discovered by microscopical examination, the question must be considered at present as undecided. The writer feels justified in asserting pretty positively from experiments of his own, that the pus in this exudate does not reach its seat on Descemet's membrane by way of the aqueous. He has produced artificially in the eyes of rabbits inflammatory conditions at the centre of the cornea, and by means of a hypodermic needle has evacuated the aqueous forty-eight hours after the commencement of the process, and at a time when the exudate on Descemet's membrane with pus cells was well marked microscopically. This was then in a small tube put in a rotary centrifugal machine, such as is used for throwing down urinary deposits, blood cells, etc. The fibrin present in the aqueous is all thrown down, but very careful microscopical examination of numerous specimens failed to reveal the presence of a single leucocyte.

The second problem to be solved in these cases is the source of the pus in the cornea, and with a brief résumé of the facts bearing on this question the writer will conclude.

In a case in many respects similar to the one we have described, and which was recently reported by Wagenmann, of Heidelberg, the latter held pretty positively to the view that the pus in the cornea proceeded from the border loop and deep ciliary vessels. In regard to the former, he could trace an uninterrupted infiltration of the anterior lamellæ of the cornea up to the border loop vessels, and it is to be observed that in most of these cases it is the anterior peripheral layers of the cornea which are most thickly infiltrated. In Wagenmann's case, he could also trace an uninterrupted row of pus cells just in front of Descemet's membrane, up to the deep ciliary vessels, whence he, with apparent good reason, concludes that the source of the pus cells in the infiltrated zone on Descemet's membrane must have been the deep ciliary vessels. In the writer's case, this was true, but not to the extent found in Wagenmann's case. Rows of pus cells could be seen on Descemet's membrane back of the ulcer, but farther towards the periphery these became very widely separated, and the posterior corneal lamellæ near the corneal border showed no discoverable infiltration. But one fact to which already attention has been called, shows unmistakably a migratory movement here towards the middle of the cornea, and that is the presence of pigment granules just in front of Descemet's membrane at the periphery, whose source evidently has been the iris or ciliary body. These pigment masses had travelled quite a distance towards the inflammatory centre in the cornea, and fine pigment granules could be detected even farther along than is shown in the drawing. That the border loop vessels are a possible source of the pus, by way of the anterior corneal layers is proven in the writer's case, inasmuch as the infiltration could be traced from the ulcer up the marginal vascular loops. But in the lamellæ at a distance from the ulcer this infiltration was exceedingly scanty, only here and there could a cell be distinguished.

In one of Bokowa's cases where the eye was enucleated eight hours after the wound and cauterization had been made, in the middle of the cornea, there was a small quantity of pus between the lamellæ adjacent to the ulcer, while at the periphery the infiltration was already considerable. The intervening cornea between the ulcer and the peripheral infiltration showed no infiltration whatever. Further in Stromeyer's experiments, he observed almost uniformly that the central infiltration was separated from that at the periphery by a zone in which absolutely no infiltration could be discovered. From this he concluded that a migration of pus cells from the wounded surface may take place whose origin is to be found in the conjunctival sac. Neither in the writer's case nor in that of Wagenmann can it be asserted positively that such a migration did not take place, although Wagenmann endeavors to show in his case that such a migration was improbable.

In regard to the pus in the cornea originating from the corneal corpuscles of which Fuchs speaks, the writer is not acquainted with any experiments proving such a source positively. It is technically difficult to introduce septic material into the substance of the cornea without leaving a track behind, through which pus cells could migrate from the conjunctival sac. Thus, an artificial intracorneal process is not easy to produce.

To sum up briefly: The pus in the hypopyon comes in the majority of cases from the uveal tract; the iris and the vessels adjacent to Fontana's spaces, while that in the cornea is derived either from the deep ciliary vessels or the anterior border loop vessels. So much is positive. As to the source of the pus cells which appear in the exudate on Descemet's membrane, very early in most cases, we are still uncertain. The pus in the cornea may be derived from the conjunctival sac, and may originate from the cornea itself. At least it has not been proven that it does not.

SOME REMARKS ON THE REFRACTIVE VALUE OF ANY TWO CYLINDERS OR OF TWO PRISMS PLACED AT ARBITRARY ANGLES IN THE TRIAL FRAME; WITH THE DESCRIPTION OF A NEW INSTRUMENT FOR FINDING THEIR SPHERO-CYLINDRICAL OR PRISMATIC EQUIVALENTS, AND ALSO THE PRISMATIC EFFECT OF THE DECENTRATION OF LENSES BY A GRAPHIC CONSTRUCTION WITHOUT CALCULATION.

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(*With seven figures in the text.*)

THAT bicylindrical lenses, *i. e.*, lenses which have a cylinder on each side, are still prescribed sometimes, is a well known fact. And yet it is now about thirty years since Donders wrote: "And in truth, bicylindrical glasses (with intersection of the axes), of which both surfaces should be either convex or concave, are never necessary: they may always be advantageously replaced by spherico-cylindrical glasses." Besides, bicylindrical lenses, on account of the difficulty to grind them, are much more expensive than their sphero-cylindrical equivalents, and it seems therefore strange that their prescription should still be insisted on here and there. Looking about for a cause, it seemed to the author that one cause at least might be that, a difficult case having been worked out with two cylinders, *e.g.*, a case of conical cornea, the conversion of these two cylinders into a sphero-cylindrical combination might not always be easy, or, at least, might be too tiresome with the present known methods. Take, for example, a prescription actually observed of $+1.50$ D. cyl. ax. 80° $\bigcirc$ -2.25 cyl. ax. 50°. Here the exact equivalent would be $-1.36^s \bigcirc +1.98$ cyl. ax. 119° 33′ 35″, or $+.62^s \bigcirc -1.98$ cyl. ax. 29° 33′ 35″, but it is only obtained after some calculation. Now the same problem of converting two cylinders at any angle to each other into a sphero-cylindrical combination further confronts us sometimes, when we have corrected a patient with his former glasses on and finally find that the added new cylinder has a different axis from the first one. Another occasion, where this problem may present itself, is on the use of Javal's ophthalmometer in such cases where there is a discrepancy between the subjective statement of the patient and the objective finding of the instrument, aud this difference cannot be explained by the position of the cylinder in front of the eye and the accompanying axial ametropia.[1] It is then desirable to determine the lenticular astigmatism to get a more accurate idea of the dioptric apparatus.

For these reasons the author thought that it might be well to simplify the present methods, and he finally devised a little instrument with which it is possible not only to determine without calculation the sphero-cylindrical equivalent of any two cylinders, but also to find in the same way the prismatic value of two prisms at any angle in the frame, and, further, the prismatic effect of the decentration of lenses, as will be shown later.

Before, however, describing the instrument, a few words must be said about the cylindrical problem in general; especially as not much has been written about the subject, as far as known to the author. Lately, in 1888, Mr. Ch. F. Prentice has given formulæ for finding the sphero-cylindrical equivalent of any two cylinders. But it takes him over forty pages to get at the result, which is then given in very long, awkward algebraic formulæ. He believes that he is the first to solve the problem mathematically; but he forgets that our old master Donders, on page 500 of his *Accom. and Refr.*, gives formulæ for finding the combined effect of two cylinders; so that priority must be given to the latter. But as Donders only gives the new cylinder and not the new resulting sphere, and as besides he only gives the radius and not the dioptric value of the new cylinder, it will perhaps be better to derive anew in a short and modified way the formulæ upon which the little instrument is constructed.

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[1] See these ARCHIVES, vol. xxii., No. 1, 1893.

It is a well-known fact that at a given point a cylinder-glass has *no* curvature in the direction of its axis and the *greatest* curvature at right angles to this axis, so that the curvature of all the other meridians changes continually from zero to this highest value. Now it can be proven by the theory of curved surfaces that if in the cylindrical surface of a cylinder-glass the radius of curvature at right angles to the axis is r, then the radius of curvature ρ in an arbitrary meridian φ from the axis can be found by the equation $\frac{1}{\rho} = \frac{\sin^2\varphi}{r}$ (I). This equation, however, gives only the radius of the osculating circle in the normal plane of the meridian φ at a given point, but not farther away from it. Furthermore, the normals of a curved surface in the neighborhood of a given normal do not in general intersect with the latter, except in the two meridians of greatest and least curvature; so that, strictly speaking, two homocentric rays going to two neighboring points of the cylinder will not again come to a focal point, as they cannot meet. For these reasons it would not seem justified to speak of the dioptric value of a cylinder-glass in an arbitrary meridian. But in our cylinders we have to do with surfaces, which have in each point very large radii of curvature, varying from infinitely great values in the direction of the cylinder-axis to $\frac{1}{4}$ or $\frac{1}{5}$ of a metre as minimal values. Besides, in looking through the cylinders we use only a very small area of its surface, not more than 5 *mm* at a time; so that at one point the osculating circle in the arbitrary normal plane expresses very nearly the shape of the surface in that direction up to 2.5 *mm* around it, up to which distance the normals also do not separate much from the first normal. In other words, the assumption is made here that for our purposes we may regard the cylindrical surface as consisting of innumerable very small band-shaped areas of spherical surfaces, the radii of which continually increase from the smallest value of about $\frac{1}{8}$ metre up to ∞. And, indeed, experiment shows that under our conditions this assumption is justified. With this understanding we may now speak of the dioptric value of the cylinder in an arbitrary meridian, and to express this mathematically we must remember that for a plano-cylindrical lens $\frac{1}{f} = \frac{(n-1)}{r}$ if f is the focal distance of our lens, r the radius of curvature at right angles to axis, and n the index of refraction of the glass used. But as $f = \frac{1000}{C}$ if C is the value of the cylindrical lens in dioptries, we have $C = \frac{1000(n-1)}{r}$ or $\frac{1}{r} = \frac{C}{1000(n-1)}$. Substituting this value of $\frac{1}{r}$ in (I) we get $\frac{1}{\rho} = \frac{\sin^2\varphi\, C}{1000\,(n-1)}$ or $\frac{1000\,(n-1)}{\rho} = C \sin^2\varphi$. Now the term $\frac{1000\,(n-1)}{\rho}$ is from the foregoing nothing but the new dioptric value of the lens in the meridian φ from the axis, so that, calling this value $C_{(\phi)}$, we have $C_{(\phi)} = C \sin^2\varphi$. If we further place a cylinder so that its axis makes an angle α with the horizontal line, then in the meridian δ from this same line we must have $C_{(\alpha-\delta)} = C \sin^2(\alpha - \delta)$, for what we called φ before has now become $(\alpha - \delta)$.

Let us now take two infinitely thin cylinders of C_1 and C_2 dioptries, C_1 having its axis at $\alpha°$ and C_2 at $\beta°$ from the zero line as Fig. 1 shows. Now the problem is to find what cylinder and what sphere united will have the same effect upon the rays of light as C_1 and C_2 together? To solve

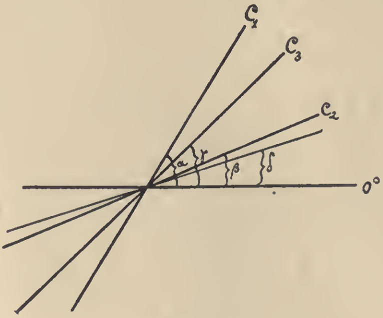

FIG. 1.

this, we take an arbitrary meridian δ from the zero line and observe what we have in this. Here the first cylinder C_1 has the refractive power $C_1 \sin^2(\alpha - \delta)$, and the second one C_2 the power $C_2 \sin^2(\beta - \delta)$, so that the combined effect of the two cylinders in the meridian δ is in dioptries $C_1 \sin^2(\alpha - \delta) + C_2 \sin^2(\beta - \delta)$. The new cylinder, which we do not know as yet, but which we will call C_3, may have its axis at $\gamma°$ from the horizontal line, then it will have in the meridian δ the value $C_3 \sin^2(\gamma - \delta)$. But this alone will not represent the combined value of the two first cylinders in the meridian δ; for we know by experience that usually a sphere must be added. Let us therefore call this assumed and unknown sphere D, expressed in dioptries, then we have for the arbitrary meridian δ the following equation:

$$C_1 \sin^2(\alpha - \delta) + C_2 \sin^2(\beta - \delta) = C_3 \sin^2(\gamma - \delta) + D \text{(II)}.$$

As the angle δ is arbitrary the equation must be correct for any value of δ, and so also for $\delta + 90$, which gives

$$C_1 \cos^2(\alpha - \delta) + C_2 \cos^2(\beta - \delta) = C_3 \cos^2(\gamma - \delta) + D \text{(III)}.$$

as $\sin(\alpha - (\delta + 90)) = - \cos(\alpha - \delta)$. By substracting (II) from (III), and remembering that $\cos^2\varphi - \sin^2\varphi = \cos 2\varphi$, we obtain

$$C_1 \cos 2(\alpha - \delta) + C_2 \cos 2(\beta - \delta) = C_3 \cos 2(\gamma - \delta) \text{(IV)}.$$

If we arrange this according to the terms $\cos 2\delta$ and $\sin 2\delta$ we get

$$(C_1 \cos 2\alpha + C_2 \cos 2\beta - C_3 \cos 2\gamma) \cos 2\delta + (C_1 \sin 2\alpha + C_2 \sin 2\beta - C_3 \sin 2\gamma) \sin 2\delta = O.$$

As δ is perfectly arbitrary, it is evident that the coefficients of $\cos 2\delta$ and $\sin 2\delta$ ought each to be equal to zero to satisfy the equation, so that we have

$$C_1 \sin 2\alpha + C_2 \sin 2\beta = C_3 \sin 2\gamma \text{ (V)}.$$

$$C_1 \cos 2\alpha + C_2 \cos 2\beta = C_3 \cos 2\gamma \text{ (VI)}.$$

By dividing (V) by (VI) we get

$$\text{tang } 2\gamma = \frac{C_1 \sin 2\alpha + C_2 \sin 2\beta}{C_1 \cos 2\alpha + C_2 \cos 2\beta} \text{ (VII).}$$

Having thus found γ from the known quantities, we find C_3, by (V) which gives

$$C_3 = \frac{C_1 \sin 2\alpha + C_2 \sin 2\beta}{\sin 2\gamma.} \text{ (VIII).}$$

The sphere is finally determined by adding (II) and (III), which gives

$$C_1 + C_2 = C_3 + 2\,D, \text{ or } D = \frac{C_1 + C_2 - C_3}{2} \text{ (IX).}$$

Before showing how (VII) and (VIII) for γ and C_3 can be graphically found without trigonometric calculations, we will give a few lines to the combined effect of two prisms: first because they will show us the geometrical meaning of the formulæ just developed, and secondly because they advocate perhaps a new idea about the graphic representation of a prism. For our clinical prisms of crown glass it is *practically* correct to assume that the deviation is proportional to their degrees, so that, *e. g.*, a prism of 8° produces 8 times the deviation of a 1° prism. This is almost entirely correct of course if we mark the prisms by their degrees of minimum deviation as proposed by Dr. Jackson, though even this would not do for fine investigations, as it is impossible to so look through a prism always that one gets the minimum deviation only. Suppose, *e. g.*, that we had a prism of crown glass with $n = 1.53$ ground to an angle of 20°, then the minimum deviation would be 10° 48′*d*, *but only on the condition that the rays from the object strike the first surface of the prism with an angle of incidence* = 15° 48′. Should, however, the prism be so placed in the trial frame that its first surface is at right angles to the line of vision, as is frequently the case, then this same prism of 10° 48′*d* would produce an angular deviation of 11° 30′, therefore almost a whole degree more. But whether we mark the prisms by their degree of grinding or by their degree of deviation, this fortunately does not affect the following lines.

We may further regard a prism as a force, that is able to displace a point looked at according to the degree marked on it in a direction of its axis, meaning by axis of a prism a line that runs over the centre of the pupil at right angles to the refracting edge of the prism, as Fig. 2 indicates.

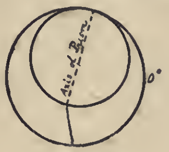

FIG. 2.

Graphically we may then represent the action of a prism by a straight line in the direction of its axis with a length of so many units as there are degrees on the prism. This is shown by Fig. 3, where *A* is the point looked at, *AP* the axis of the prism, α the angle of the axis, with the horizontal zero line of the trial frame and *A A′* the deviation produced by the prism of so many degrees as there are units in *A A′*. Suppose now that we looked at the point *A* with two prisms, one of 3° with axis at $\alpha°$ and one of 2° with axis at $\beta°$, α and β being indicated by the position in the trial frame of the mark on the prism at its apex. Then, as Fig. 4 shows, the first prism would displace *A* to *A′* by three units, and the second one would bring *A* to *A″* by two units, if either prism acted by itself alone. If, however, both prisms act at the same time, then we have certainly the same problem as in physics when we ask what will be the result if two different forces act under different angles on the same

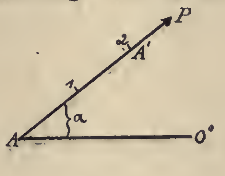

FIG. 3.

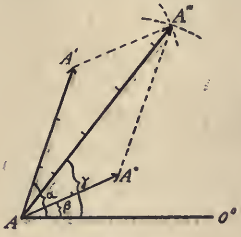

FIG. 4.

point. We know that then the diagonal of the parallelogram of forces will give us the resultant, and so we see here that the resultant of the two prism-forces $A\ A'$ and $A\ A''$ will be $A\ A'''$ if $A\ A'\ A'''\ A''$ is the parallelogram, constructed out of the two prism-forces by drawing an arc of a circle with radius $A\ A'$ from A'' and one from A' with a radius of $A\ A''$. The point of intersection of these two arcs will be the point looked for and line $A\ A'''$ will give by its length, in the same units as for $A\ A'$ and $A\ A''$, the degree of the new prism and by its angle γ with the zero line the angle, at which the axis of the new prism has to be placed in the frame.

To get mathematical expressions for these values, we have in the triangle $A\ A''\ A'''$ the proportion $A\ A'' : A''\ A''' = \sin(\alpha - \gamma) : \sin(\gamma - \beta)$, or, if we call the prism-forces in the same units P_1 and P_2 we get $P_2 : P_1 = \sin(\alpha - \gamma) : \sin(\gamma - \beta)$, which gives the new angle γ by

$$\text{tang}\ \gamma = \frac{P_1 \sin\alpha + P_2 \sin\beta}{P_1 \cos\alpha + P_2 \cos\beta} \text{ (X).}$$

We also can draw from the diagram directly $P_3 \sin\gamma = P_1 \sin\alpha + P_2 \sin\beta$ or

$$P_3 = \frac{P_1 \sin\alpha + P_2 \sin\beta}{\sin\gamma} \text{ (XI.)}$$

These two last equations are identical in their form with (VII) and (VIII) if we only there regard 2α, 2β, and 2γ as the angles involved, and therefore it will be evident that we can use the same construction for the cylinders as for the prisms.

This forms the basis for the construction of the little instrument as made for me by Mr. D. V. Brown, of Philadelphia. It consists essentially of three parts, a circular protractor, a round glass plate, and a brass ruler. The circular protector has a diameter of a little more than 20 *cm*, and its numbers run from 0 to 360° in the same direction as they are counted in trigonometry and usually in the trial-frame. Diameters are drawn from 5 to 5° and besides concentric circles, each having a radius 5 *mm* larger than the foregoing. Upon this protractor and centred with it lies a circular glass-plate, which is frosted so that it may be written on, and which has etched on it a diameter, as Fig. 5 shows.

This diameter is subdivided into five units on each side of the centre, each unit of 2 *cm* length being subdivided again, so that the quarters can be read off conveniently. There is also at 43.6 *mm* from the centre a red point, the significance of which will be shown later. At right angles to this diameter on the glass plate there is a radius, also subdivided into five units on one side. But on the other side it has red numbers for a unit four times smaller than the first, so that, *e. g.*, where the black number 2 appears on the one side, there is a red number 8 opposite to it.

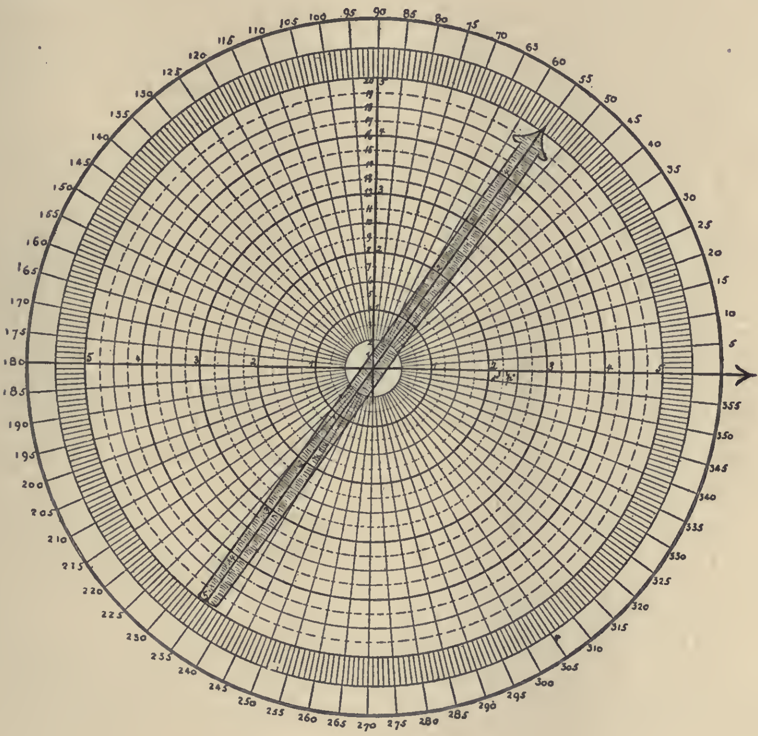

FIG. 5.

The third part of the instrument is a brass ruler that is divided in the same manner as the diameter on the frosted plate before referred to, without, however, the red mark on it. This ruler is centred with the glass plate and can be rotated to any desired angle.

To find the sphero-cylindrical equivalent of two cylinders proceed now as follows:

1. Turn the glass plate around till the arrow-head of the described diameter points to $2\,\alpha$, if the axis of the first cylinder is at α° from the horizontal line, and mark down a point that coincides in numerical value with the dioptric value C_1 of the cylinder; putting the point down towards $2\,\alpha$ from the centre if the cylinder is positive, but putting it down in the opposite direction—that is, towards $2\,\alpha + 180$, if the cylinder is negative. Thus get the first point corresponding to A' in Fig. 4.

2. Turn the ruler till it stands with its arrow-head at $2\,\beta$; then lay down C_2 units, towards $2\,\beta$ if C_2 is positive, but towards $2\,\beta + 180$ if it is negative. Thus get the second point correspondingly to A'' in Fig. 4.

3. Now construct the parallelogram (as indicated in Fig. 4 and described before) and draw the diagonal $A\,A'''$.

4. The diagonal, $A\,A'''$, gives the dioptric value of the new cylinder C_3 by the number of units it contains, which units may be either read off directly by the concentric circles or $A\,A'''$ may be taken between the points of compasses and thus measured along the ruler.

5. The angle, towards which the diagonal points, gives $2\,\gamma$, so that by halving this number we get the axis of the new cylinder, which latter must be reckoned positive if $2\,\gamma$ is taken in the way indicated.

6. Find the sphere D of the sphero-cylindrical combination by $D = \frac{C_1 + C_2 - C_3}{2}$, being careful to give in this formula to each cylinder its proper *algebraic* sign.

To find the lenticular astigmatism of the eye in amount and axis one must put down the corneal astigmatism C_1 as indicated in Fig. 6, C_1 having been determined by a good ophthalmometer and corrected for its position in front of the eye as shown elsewhere.[1] In the usual way put down also the whole astigmatism C_3 and now construct the new parallelogram. Here, however, it must not be forgotten that C_3 is really the diagonal, being the resultant of the corneal and lenticular astigmatism, so that our problem is to find the other side of the parallelogram. To do that draw a circle from A with radius $C_1\ C_3$ and another with the radius $A\ C_1$ from C_3. The point of intersection gives point C_2, and line $C_2\ A$ gives by length and direction the amount and angle of the lenticular astigmatism, which is thus found rather too small, as the crystalline lens lies so much deeper in the eye. The sphere can then be determined by 6.

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[1] ARCH. OF OPHTHALM., January number of 1893.

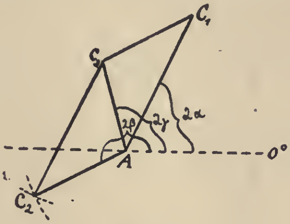

FIG. 6.

From what has been said before about prisms it will be clear without further comment how to proceed with two prisms. It may be remarked, however, that this construction will often save much trouble and time, so that, for example, a rotary prism can be plotted out in a few minutes almost, and the table of Dr. J. Wallace, in the *Annals of Ophthalmology and Otology*, April, 1892, can be constructed without the slightest difficulty, especially if with the angle of rotation we discard the minutes as clinically worthless, and if we are content to get the new prism accurate within the one eighth of a degree.

It may be further interesting to show how the instrument may be used by any one to construct a phorometer. A patient with heterophoria may be considered as having orthophoric eyes, in one of which there is constantly present an imaginary prism corresponding in degree to his heterophoria, and having its apical point to the side opposite to his deviating tendency, so that that eye is obliged to deviate in that direction to maintain single vision. It is clear that the trouble will be corrected by counteracting this imaginary prism by another one of the same power, but having its apical point in the opposite direction, *i. e.*, in towards the nose in esophoria, and *vice versa* in exophoria. If we now put a prism with its apex at 90° in front of a patient with lateral heterophoria, we find that we have to turn the prism out or in, in order to produce vertical diplopia, the amount of turning of course being dependent upon the amount of deviating tendency. To find the degree of rotation necessary for the different degrees of heterophoria, proceed thus on the glass plate. Mark down, as Fig. 7 shows, a point B on the diameter corresponding to one degree. Draw a line parallel to AD, which represents the radius with the black and red numbers. Take a line between the two points of your compasses corresponding in length to the number of degrees of the prism used, and draw a circle with this radius from A, which may cut EB at A'. The angle $A'AB$ is then the angle to which the vertical prism has to be rotated to produce vertical diplopia if there is present *one* degree of heterophoria. The same construction may be gone through for two, three, four, etc., degrees of lateral deviation to find the corresponding angles, and these different angles may then be marked down on the trial frame, so that the heterophoria can be read off immediately.

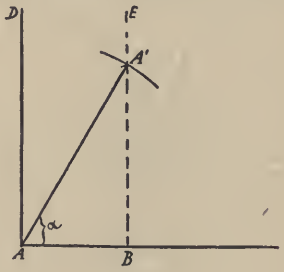

FIG. 7.

One may object to the present construction of the instrument as having only five units on each radius, so that it will not allow to give the construction for a 10° prism. But in this case all that is necessary to do is to let each unit stand for two units or, what is the same, divide all your prism-degrees by two, and proceed as before. The angle will remain the same, but get your new prism by multiplying your result by two. In the reverse, if we had to deal with very small quantities, if *e. g.*, we had to combine a .25 and a .50 cyl., then it would be better to multiply both by a convenient number, as 4, and work as if we had a 1. cyl. and a 2. cyl.; if we only remember that the resulting cylinder must be divided by four. We can thus get results which are often far ahead of the optician's grinding tools, as is shown by the example given in the beginning of this paper; so that in practice only the nearest values can be taken; *e. g.*, if the instrument demands a .45 cyl., and we probably have to be satisfied with a .50 cyl. Of course it would be ridiculous to have special tools made for such small differences, as the latter are usually smaller than the errors, or at least fluctuations in the observations of the patients.

It remains only to show now how with the new instrument the prismatic value of the decentration of lenses may be determined. To do that one must remember in what relation these quantities are to each other. There are many ways of deriving the formula.

Perhaps the simplest is that by Dr. Ward A. Holden, given in these ARCHIVES, vol. xx., No. 1, pag. 20. The formula is tang $A = \frac{d}{f}$, which may be written tang $A = \frac{dD}{1000}$, where A is the *angle of deviation* produced by the decentration, D the dioptric value of the lens, and d the amount of decentring in millimetres. Now with our small angles A, not going beyond 4 degrees for each eye, we may make tang $A = 2\,A$ tang $\frac{1}{2}$, which gives $2\,A$ tang $\frac{1}{2} = \frac{dD}{1000}$. The value of tang $\frac{1}{2}$ is 0.008726, and therefore we obtain $\frac{2A}{D} = \frac{d}{1000\,\text{tg}\,\frac{1}{2}} = \frac{d}{8.72}$.

To find d by the instrument according to this formula, proceed now as follows: Disregard the brass ruler altogether. Mark down on the diameter with the two red marks on it a point corresponding to the dioptric value of the lens, and on the radius a length corresponding to *twice* the desired angle of deviation with reference to the black numbers. Join these two points by a straight line, and draw another line parallel to this from the point d°. The point where this line intersects the radius, gives by the red numbers in millimetres the amount of decentration necessary to produce the angle A of deviation. Each millimetre is represented here by a space of 5 *mm*, because the point d° has not been taken at 8.72 *mm* from the centre, but at 43.6 *mm*. This artifice allows to read off the tenths of a millimetre without any trouble.

The foregoing procedure gives the decentring of lenses if the prismatic effect is given in degrees of (minimum) deviation. If, however, the prismatic effect is given in degrees of the refracting angle of a prism, then we must consider that the degree A of minimum deviation of a prism with the refractory angle P and the index of refraction n of the glass are connected by the equation $n = \frac{\sin \frac{1}{2}(A+P)}{\sin \frac{P}{2}}$. From this we easily obtain tang $\frac{P}{2} = \frac{\sin \frac{A}{2}}{n - \cos \frac{A}{2}}$. As $\frac{A}{2}$ does not surpass 4° in practice, we may put $\cos \frac{A}{2} = 1$, and have then tang $\frac{P}{2} = \frac{\sin \frac{A}{2}}{n - 1}$. This gives us for our small angles P tang $\frac{1}{2}$ $= \frac{A \sin \frac{1}{2}}{n - 1}$. And further, if we assume $n = 1.53$, we get $A = 0.53002\ P$. Substituting this value for A in our former formula for the decentring of lenses, we obtain $\frac{d}{9.25} = \frac{P}{D}$. By this equation we may now easily find d as before, but with this difference, that we must mark down on the radius a point corresponding to the *single* refracting angle of the prism, and must take as the starting-point for the parallel line not the former point d°, but the second red point p°.

With regard to the accuracy of the instrument, the author believes that the following claim will, on the whole, be substantiated by others. The new cylinder, and therefore the new sphere, can be obtained correctly within the $\frac{1}{8}$ of a dioptry, and so the new prism within the $\frac{1}{8}$ of a degree. The degree of the axis of the new cylinder or prism will be found to be correct within ½°, and the amount of decentring within ¼ of a millimetre. For clinical purposes, therefore, the instrument will be perfectly sufficient.

As the main feature of this little contrivance consists in the possibility of finding the new cylinder by a *graphic* method, the author proposes for it the name *Cylindrograph.*

PHILADELPHIA, June 8, 1893.

TEMPERATURE-TOPOGRAPHY OF THE EYE AND WARM AND COLD APPLICATIONS.

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Translated by CHARLES H. MAY, M.D., New York.

OUR knowledge of the temperature-topography of the eye, a subject which has not occupied space in these ARCHIVES, is based upon the investigations of Prof. Michel.[1] He experimented on rabbits, using the thermo-electric couple; his average temperatures were 31.9° for the anterior chamber and 36.1° for the middle of the vitreous and for the lens. There was a fall in temperature when the point of a needle was carried from the middle of the anterior chamber towards the cornea, and a rise when it was brought near the anterior surface of the iris; in the vitreous, the temperature increased on approaching the walls of the eyeball and became equal to that of the body when the needle pierced these. Closure of the lids caused an increase of from 2° to 3° in the anterior chamber; the application of an ice-bag caused a fall of from 13° to 15°. Treatises on physiology do not mention the subject. Investigations, similar to those just quoted, had previously been carried out upon the human conjunctiva, by means of variously constructed thermometers. Thus Eulenburg[2] and Gradenigo[3] mention elevations of temperature in inflamed eyes, but give no figures. In Dohnberg's[1] thesis, numerous measurements are given; he made use of thermometers, to the bulbs of which, plates, 2 *cm* × 4 *mm* × 3 *mm*, were joined. The concavo-convex mercury plates were placed in the lower conjunctival sac, while the thermometer was retained in position by two pairs of clamps attached to a brass forehead band, during periods of observation lasting twelve minutes each. The average difference in temperature between the axilla (37.91°) and the conjunctival sac (35.8–37.0°) was 0.5°. He found the following differences between healthy and diseased eyes: In inflammatory affections of the conjunctiva 0.52°, of the cornea 0.46°, of the iris 0.77°; in glaucoma, 0.58°; there was no difference in inflammations of the choroid and of the retina. Galezowski[2] put the temperature of the normal conjunctival sac at 36.5–36.7° and gave 0.8–1.0° as the increase in inflammations. He found that in certain cases of iritis and keratitis, the temperature was the same as that of the body or even lower. In the investigations just mentioned, there were a number of possible errors associated with the use of thermometers in such delicate investigations, due to evaporation, conduction, and lengthy duration, which errors could be avoided by the use of the thermo-electric couple; again, no investigations have been conducted on man, by this method. These circumstances, as well as several therapeutic questions, made the corroboration of the above-mentioned results seem desirable.

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[1] "Zur Temperatur-Topographie des Auges." *v. Graefe's Archiv*, Bd. xxxii., 1, 226.

[2] Eulenburg's *Lehrbuch der functionellen Nerven-Krankheiten*, 1871.

[3] Gradenigo, "La termometria dell' Occhio." *Ann. di Ottalm.*, vi., 2, p. 177.

The experiments were conducted in the Physiological Institute of this city; and I am indebted to Prof. König for the use of apparatus and to Dr. Wolff for active assistance. I used thermo-electric couples made of copper and iron, so that the coverings of the eyeball could be perforated with ease. Both ends of an iron wire had copper wires soldered on; these were rounded off at one end (for mouth and rectum) and supplied with a conically pointed iron extremity

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[1] Dohnberg: *Die Temperatur des Auges unter physiolog. und pathol. Verhältnissen.* Inaug. Dissert. Dorpat, 1876.

[2] Galezowski: "De la termométrie en ophtalmologie." *Rec. d'opht.*, 1877, pp. 275 and 307.

2½ *mm* long (perforating needle) at the other. The copper wires were connected with Thomson's galvanometer.[1] Upon closure of the current, there was a deviation of the magnet when there was a difference of temperature between the soldered ends, the thermo-electrical force being proportional to this difference. Other currents occurring with closure and constant temperature were calculated in advance and allowed for in the calculation. Opposite the mirror was a scale divided into millimetres. Any number which could be read by telescope and located by crossed threads could be read in the mirror. When deviation of the magnet occurred upon closure of the current, a different number replaced that which indicated the original meridian. The amount of deviation corresponding to a temperature difference of one degree, was calculated empirically several times during each day when experiments were conducted ; in this manner, differences in temperature could easily be estimated. We were usually able to estimate the fortieth part of a degree within a few seconds ; this rapid estimation is important, since a delay of any time occasions innumerable variations through secondary currents and changes in temperature, which interfere with positive results.

Michel placed one electrode in the eye of an animal and the other in a glass of water at 40°. Upon closure of the current there was a certain difference of temperature ; then, taking into account the rectal temperature, he arrived at certain figures indicating the temperature of this or the other part of the eye. We did not deem it prudent to follow this method ; for, in the first place, it is difficult to keep water at a constant temperature, say at 40°, and secondly, the rectal temperature of narcotized animals is subject to great variations and unless constantly measured will be an element of error. For example, in a dog under the influence of small doses of morphine and kept under ether, the rectal temperature first rose 1.2° and after half an hour fell 1.5° below the normal. On this account, we placed one electrode in the rectum of the dog or the mouth of the human subjects of experimentation, at the same time that the other electrode was introduced into the eye; in this way we obtained correct figures of the rectal temperature and of the difference between this temperature and that of the eye; and we could thus easily establish the temperature of the organ or parts of the organ by calculation. The investigations were made in rabbits, dogs, and men, in normal and pathological conditions, with and without anæsthesia. In experimenting upon men, we must expect erroneous results often, since we cannot always succeed in placing and keeping the electrode in a desired portion of the eye without inflicting injury upon the patient's cornea. Strictly speaking, the figures give the temperature of the lower retrotarsal fold and ocular conjunctiva of the lower portion of the eyeball; but on account of the intimate connection between the blood-vessels of the conjunctiva and those of the entire eyeball, and on account of the isolated position of the eyeball surrounded for the greater part by a bony wall, it is not improbable that changes of temperature within or on the eyeball can be determined with approximate accuracy in the conjunctival sac. The use of cocaine was contra-indicated on account of its influence upon temperature; the feeling of coldness after instillation is mentioned by many patients. In some cases we used tropacocaine,[1] an anæsthetic recently produced by Dr. Chadburne in Liebreich's laboratory, and now manufactured in the Braunschweiger Chininfabrik. Incidentally, it may be mentioned, this remedy used in a 3% solution of a pure preparation causes such complete anæsthesia within a few seconds that a foreign body can be removed from the cornea without the slightest pain. In iridectomy, squint operations, etc., this base has been found to be excellent on account of its rapid action when instilled during the course of the operation, as, for instance, upon the muscle tendon after division of the conjunctiva. It seems to have no effect upon intraocular tension.

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[1] Compare Pfaundler, Müller-Ponillet's *Lehrbuch der Physik*, iii., pp. 601 and 940 ; Landois' *Textbook of Physiology*, 1889, p. 401.

To begin with, we could assume that the temperature of the surface and interior of the eye would be less than the bodily temperature (which was found to average 38° rectal, in rabbits, 39.2° rectal, in dogs, and 36.9° in man, tongue), on account of exposed position, evaporation of tears, and limited blood supply of certain parts of the eye. The figures which follow represent averages.

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[1] Chadburne, "On the Value of a New Cocabase: Benzoyl Ψ Tropein (Tropacocaine), as a Local Anæsthetic," *Brit. Med. Jour.*, No. 1651, p. 402.

In the dog, we found the following temperatures: Anterior lamellæ of the cornea, 29.58°; anterior chamber, 34.49°; anterior surface of iris, 36.77°; in the lens, 36.55°; in the vitreous, 36.06°; an increase of several tenths of a degree on approaching the walls of the eyeball; optic foramen, 39.3°. Rectal temperature, 40°.

In rabbits (rectal temperature 38.6°) the figures differed somewhat: Conjunctival sac, 35.4°; anterior chamber, 32.1°; lens, 35.46°; iris substance, not more than 0.5° less than rectum; centre of vitreous, 33.5°; just in front of optic nerve, 35.16°. Apparently these figures do not agree, but in reality this is not the case, since the rectal temperature of the anæsthetized dog averages 1.5° more than that of the rabbit. Taking all circumstances into consideration, we are justified in saying that the conjunctival sac has a temperature of 2°, corneal lamellæ 10°, anterior chamber 6°, lens 3°, iris substance 0.36°, and centre of vitreous 4° less than the rectal temperature. These figures agree approximately with those given by Michel. The instillation of cocaine caused a fall of temperature of 0.5° in the conjunctival sacs of the animals. In man, the temperature of the lower conjunctival fold was found to be 35.55° (Dohnberg 36.40°), that is, about 2° less than in the rectum. Cocaine reduced this 0.81° = 34.74°; in inflammatory affections (scleritis) the minimum effect was 0.1° to 0.2°.

In all inflammatory affections the temperature was elevated as compared with the healthy eye: In acute conjunctival catarrh 0.93°; episcleritis, 0.49°; burn of cornea from lime, 1 29°; hypopyon keratitis, 1.45°; corneal ulcer from gonorrhœal conjunctivitis, 0.8°; two cases of acute iritis, 1.56°; dacryo-cystitis, 0.58°; acute irido-choroiditis, with opacities of vitreous, 1.18°. The highest temperature was found in acute iritis, but even this did not equal the temperature of the body. In no case could a febrile elevation of bodily temperature be demonstrated as a result of the local inflammatory process. According to the figures just given, eyes suffering from inflammation, average 0.98°, increase in temperature as compared with healthy eyes. Dohnberg found 0.59°, and also found that the greatest elevation occurred in iritis; this is probably due to great metamorphosis in this disease—cell production and cell degeneration; hyperæmia alone could not cause the elevation of temperature, for there is much more hyperæmia in blennorrhœa, which has a lower temperature. This seems to indicate that the arterial current, leading to an inflamed area, is cooler than the inflamed area itself, which is the seat of active metamorphosis, and than the venous current, which leaves this area.

Next I commenced the study of the effect of warm and cold applications upon eyes. This I did for theoretical reasons as well as to throw some light upon the question of which form of application was more suitable in cases of gonorrhœal conjunctivitis, complicated with corneal ulcer. The various text-books do not answer this question satisfactorily—some advise ice applications in these cases, others are opposed to the use of these. And the opinions of various authorities in this country and abroad differ just as much as do the text-books. On this account we made use of applications of various degrees of temperature on an extensive series of patients, and obtained the following results:

1. Gonorrhœal conjunctivitis, ulcer of cornea. Ice compresses, wrung out well, applied to the lids for ten minutes, caused an *increase of temperature* of 2.24° in the lower conjunctival sac.

2. Purulent conjunctiva, corneal ulcer. Ice compresses, wrung out moderately, applied for fifteen minutes, caused a fall in temperature of 0.45°; after several seconds the temperature rose 1.31°, and remained at this point. Probably the electrode was influenced at first by the water adhering to the margins of the lids.

3. Iritis. Ice compresses of 5°, applied by the patient, caused a diminution of temperature of 4.8°. Immediately after drying the eyes, there was a rise of 1.9° above the

temperature before the applications. I believe there must have been considerable cold water in the conjunctival sac.

4. Iritis. Compresses of 40°, well wrung out, applied ten minutes, produced a fall of temperature of 0.95°.

5. Glaucoma absolutum. Moist sublimate dressing for two hours was followed by a diminution of temperature of 2.12°; then warm compresses, 38°, for fifteen minutes, caused an additional decrease of 0.03°.

6. Iritis. Applications of 50° for fifteen minutes caused a fall of temperature of 0.6°.

7. Ulcer of cornea, with marked chemosis of the ocular conjunctiva. Applications of 50° for fifteen minutes caused a fall of 0.93°.

I do not wish to hide the fact that several experiments gave results which were just the opposite of the above—just as in Case 3 there was a fall of temperature after the use of ice, there was a rise after the employment of warmth. In these cases I assume that some of the hot water reached the conjunctival sac. This cannot be proven, but this is the probable explanation, since when this was avoided, as for instance when dry ice compresses were used, these exceptions did not occur.

If these experiments are correct, and the difficulty of exactness is self-evident, we would conclude that the compresses usually prescribed by oculists (for instance, applications at a lower temperature than the surrounding air, for fifteen to thirty minutes three times a day) cause an increase in the temperature, and that compresses warmer than the surrounding atmosphere cause a diminution in the temperature of the conjunctival sac. This effect is due to the fact that the elastic blood-vessels of the skin are contracted by the application of a temperature less than that of the surrounding air and the blood is driven deeper; in the opposite condition the blood-vessels are dilated, and thus the blood is led from the deeper parts, *i. e.*, from the conjunctival sac to the skin. And, independent of centripetal and centrifugal fluxion, the application of cold is accompanied by a reflex increased production of warmth with diminished escape of warmth; while with warm applications, the production of heat is diminished, and the escape is facilitated by dilatation of cutaneous blood-vessels and swelling of the skin. Both factors, fluxion and reflex influence upon the production of heat, cause an increase of temperature in the conjunctival sac with cold and a decrease with warmth, exactly as we found occurred experimentally. Whether the same thing occurs after the application of cold for a number of hours, when paralysis of the cutaneous blood-vessels results, I cannot say, since I did not find time to continue the applications for three hours and longer. With warmth, the effects will last indefinitely, for theoretical reasons. The very noticeable redness of the lids after the use of ice applications in gonorrhœal conjunctivitis might be cited as being a contradiction to what has just been stated; but in such a case, in the first place, the lids are very red to start with, in consequence of the inflammation, so that slight changes are not appreciable; secondly, the skin is constantly being less macerated by the compresses, so that as a result of the ensuing transparency the hyperæmia caused by vascular constriction is more distinctly visible; and thirdly, the anæmia, as a secondary consequence of which the increase in temperature of the conjunctival sac takes place, need not be so pronounced as we see it in the first stage of the freezing of a part—the ear, for instance.

The following experiment may possibly serve to support the views just mentioned: Normal conjunctiva, instillation of cocaine, fall of 0.7°; cold applications, of 8°. There was no change of temperature, especially no increase of temperature, which was to be expected according to the observations mentioned above. This is explained by the fact that the blood-vessels contracted by cocaine could not expand to receive the increased volume of blood. It is different, naturally, when cold water is applied through the open eyelids after an application of nitrate of silver; for, in such a case, there is a cooling of the mucous membrane, just as the application of cold to the skin produces a reduction of temperature in the latter. In cases of blennorrhœa with great chemosis, the upper lid overlapping the lower, we can scarcely expect any water to reach the eye from the ice compresses, wrung out as they usually are. Hence there is no cooling and no diminution in metamorphosis in the threatened cornea. On the contrary, if the applications are continued for fifteen or thirty minutes only, during which period there would be no vascular paralysis, we cause congestion of the eye and thus furnish favorable conditions for continued jeopardy of the cornea. This explains to me why patients with inflammatory affections of the eyeball usually prefer warmth—the latter causes relief in the congested organ. If warmth were applied to the eye by the warm applications, an explanation which is usually given, we would increase the hyperæmia in iritis, for instance, and interfere with the dilatation produced by atropine; for mydriasis requires a diminution in blood supply; this is best obtained by the wet compress causing cutaneous hyperæmia and maintaining it for several hours—a sort of continuous cupping. The agreeable sensation of cold in acute conjunctival affections can be attributed in the first place to cold water entering the conjunctival sac, and secondly to a cutaneous sensation—a feeling of coolness of the skin produced by vascular constriction and conduction, and referred psychically to the conjunctiva. Sensations cannot always be exactly localized. Be this as it may, the result of both cold and warmth is to excite metamorphosis by means of fluxions, and thus they tend to produce an approach to normal relations. As an illustration of this we may cite the fact that in iritis, for example, some oculists find cold useful, while others use heat combined with atropine.

While conducting these experiments, I thought it pertinent to estimate the influence of warmth and cold upon other organs:

1. Gray rabbit of medium size. Rectum 38.0°, rising to 39.3° after injection of 0.03 morphine. (Large doses cause instant fall in temperature, while in smaller doses this diminution does not occur until later.) One electrode was placed in the rectum, the other in the abdomen immediately in front of the vertebral column. Ice-bag upon the abdomen;

in five minutes, rise of 0.4°; in twenty minutes, 0.63°—compared with the rectal temperature, which had fallen during the course of the experiment.

2. Young dog, black, large size. Rectum 39°. Ether narcosis and morphine subcutaneously. Small trephine opening in the right side of the skull. Electrode introduced into the cerebrum. Rectum now 39.3°. Cerebrum 38.85°. Mendel[1] found the temperature of the cerebral cavity in animals on the average 0.7° less than in the rectum. Chloroform, chloral, and morphine caused a fall in temperature both absolutely and relatively as compared with the temperature of the body, while alcohol caused a rise. Large ice-bag kept upon the skull for five minutes; temperature rose 0.23° = 39.08° (38.85 + 0.23°); in twenty minutes it reached 40.23° (38.85 + 1.38°); rectal temperature 40°. Preceding the experiment the cerebral temperature was 0.45° lower than that of the rectum; after the experiment, 0.23° higher. The temperature of the organ which we wished to cool by means of a universally accepted method was increased. The results of warm compresses upon the abdomen were too contradictory to be given. But according to the analogy of the results in man, we may conclude that they can diminish the temperature of the deeper parts when not used too extensively nor for too long a time and when used in the degrees of temperature mentioned above. The relations naturally become changed when larger masses of warm or cold water are brought in contact with considerable portions of the body, as, for instance, in bathing. Even sponging the body with water of 9–10° caused a fall in temperature of the skin, rectum, and axilla (Senator and Winternitz[2]), the fall in the rectum being usually preceded by a brief increase. The cooling effect of cold baths, especially in febrile, typhoid affections, is well known, and it is equally certain that baths of 40° increase the temperature of the body. With this temperature the production of heat is made slower, but the temperature is really increased. No heat can be given

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[1] Mendel, *Virchow's Arch.*, 1870, S. 12.

[2] Rosenthal, "Physiol. der thier. Wärme," in Hermann's *Lehrbuch der Physiologie*, 1882, iv., S. 492.

off from the body by conduction to the warmer, watery surrounding medium; evaporation by sweating and by breathing then act as regulators; but they cannot prevent an increase in the temperature of the body.

Hunter's experiment[1] cannot be considered as contradictory to what we have found to be the changes in the temperature of the conjunctiva—increase with cold, diminution with heat. He found the temperature of the penis at a depth of 2″ to be 93° F., and after immersion in hot water (118°) it rose to 102° F.; the intensity of the water was so great, and the separation of the thermometer by the wall of the urethra so little, that we can imagine the thermometer placed almost directly in the water. The same may be said of Michel's[2] results, in which opacity of the lens was produced by application of an ice-bag upon the eye of a young cat, which opacity disappeared immediately upon removal of the ice-bag.

Considering the results in general, they correspond with what physiology teaches us—that high temperatures cause dilatation and low temperatures constriction of the blood-vessels of the skin, in the former case with secondary increase, in the latter with secondary diminution in escape of heat. What is true of the entire body must be applicable to a single part, notwithstanding the equalizing effect of the circulation. Looking at the practical side, we shall continue to do as we have been taught by experience in thousands of cases. In treating the unconscious subject of apoplexy, we shall continue to apply an ice-bag to the head just as we always did—not, however, for the purpose of exerting a quieting effect, nor to control inflammation, nor to prevent subsequent hemorrhages—the temperature will rise with dilatation of the blood-vessels occurring at the same time—but we apply the ice-bag as a local stimulant, which acts in a refreshing and stimulating manner, and one which will be found agreeable after a return of consciousness, just as we use Eau-de-Cologne and the migraine pencil upon the forehead and temple. A poultice applied to the side of the thorax affected with pleurisy conducts towards the skin, and thus diminishes the quantity of blood and the temperature in the pleura. I do not wish to increase the number of examples, but will close with the wish that the experiments just described, which have led to such interesting conclusions, may be repeated and extended by some one who is not handicapped by the burden of practical activity.

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[1] Rosenthal, "Physiol. der thier. Wärme," in Hermann's *Lehrbuch der Physiologie*, 1882, iv., S. 383.

[2] Michel, "Ueber natürliche und künstliche Linsentrübung." Festschrift zur 3. Säcularfeier der Alma Julia Maximiliana, gewidmet von der med. Fakultät zu Würzburg, 1882, i., 53.

OBSERVATIONS ON FOUR HUNDRED AND SIX CATARACT EXTRACTIONS, PERFORMED BY PROF. HAAB OF ZURICH.

COLLECTED BY DR. THEODOR ARNOLD.

Translated and abridged by Dr. J. A. SPALDING, Portland, Me.

THE material upon which this paper is based, was chosen from 33,184 patients, of whom 13,723 were seen in private practice. The number of extractions was in all 406, divided as follows:

I. Simple senile cataracts, or with but slight complications	302
II. Lamellar cataracts	56
III. Congenital cataracts	11
IV. Complicated cataracts	37
Total	406

Two hundred and seventy-one of the uncomplicated cataracts were extracted with an iridectomy. When we read how often in the simple extraction the prolapse of the iris not only threatens, but in spite of eserine, and a permanent pressure bandage, and the greatest possible rest in bed, actually occurs, we can easily comprehend how the experienced Prof. Knapp in his latest publication on this subject in these ARCHIVES calls the prolapse of the iris "the weak side of simple extraction."

Furthermore, there are many cases of loss of vitreous reported in the latest papers on simple extraction, even when the section is made completely within the cornea, and the patient operated upon in the bed in which he is to remain until recovery takes place.

It is, of course, impossible not to be obliged to perform secondary operations even after extraction with iridectomy, if we desire to give our patients the greatest possible amount of good sight. And this is what most of the patients desire. For, in the struggle for existence in our days, good sight is of the greatest importance to those of the working classes. Therefore, Prof. Haab makes a secondary division of the capsule, and almost always a successful one, in every case in which after a reasonable time from the primary operation, vision is not better than $\frac{1}{2}$.

In lamellar cataracts, too, in order not to be satisfied with but half sight, we have ceased to make purely optical iridectomies. For in a number of cases that we followed out with care, the visual results were far from satisfactory, in enabling the patient to earn his living. For these reasons, we now discind every lamellar cataract, with or without iridectomy, and remove the lens in toto. A good result is generally obtained in two or three months, and this is all the more important for the patient, since more than a majority of them are either mentally affected, or are below the average of intelligence. Hence, half sight hinders them in their development, to which is often added a certain mental depression, which after a successful operation gives way to increased mental activity.

The entire series of cases here published contains but a single one of loss by infection, with subsequent suppuration of the globe, and for that reason I shall once more insist on the importance and absolute indispensability of exact asepsis in all operation upon the eye.

The manner in which we act in these cases is as follows: On entering the hospital every patient has a complete bath, which is repeated on the evening before the operation. No patient is ever operated upon on the day he enters the hospital. The greatest attention is paid at the patient's first visit to any anomalies of the conjunctiva, lachrymal sac, and canal, and if any such are discovered, treatment is at once instituted, and often kept up for weeks, either by the application of proper remedies to the conjunctiva, or by probing and syringing the canals and sac with weak sublimate solutions. All pterygia are abscissed before the extraction of the lens. If stenosis or enlargement of the lachrymal sac is perceived, the entire region is repeatedly syringed out on the day before the operation, and the two puncta cauterized with the glowing galvano-cautery, so that they are hermetically sealed, and the passage of infectious material from the nasal passages prevented. Special attention is also paid to the eyebrows, and occasionally the eyelashes are cut off, a proceeding which was, however, followed by so much irritation from the new growth, that it was not repeated many times. It is generally sufficient to wash the entire region with soap and sublimate solution the day before, then to apply a moist pack with sublimate throughout the night, and then once more before the operation, to cleanse the parts with scrupulous care, as before.

A few drops of a 2 to 4 per cent. solution of cocaine (boiled just before instillation) completely anæsthetize the cornea in a few minutes. The eyelids are then everted with care, and liberally washed with a weak, *warm* sublimate solution. If the conjunctival fold appears in the least suspicious, it is now energetically rubbed with a stronger sublimate solution, applied with absorbent cotton. Although considerable reaction in the form of chemosis often ensues, especially in older or infirm people, this is not to be feared, as we have never seen any danger ensue to the eye after energetic use of any sublimate solutions. The only point to guard against is to prevent the entrance of such solutions into the anterior chamber in any way, lest the cornea become indelibly stained, and the sight seriously affected.

All of the instruments to be used in the extractions are previously placed in a three per cent. solution of carbolic acid and used without being dried or wiped.

Although the operator or the assistants never come into contact with the cutting parts of the instrument, their hands are carefully cleansed at the time of the operation with brush, soap, and sublimate.

A speculum, light in weight, with a soft spring and easily removable from between the lids is used to separate the latter.

The operation is made with a Graefe knife, with a flap of between 2 and 3 *mm*, with puncture and contra-puncture in the sclera or limbus. The formation of a conjunctival flap is not insisted upon, though Professor Haab thinks that its presence ensures rapid closure of the incision.

When a preparatory iridectomy is made with or without massage for the maturation of a possibly immature cataract, the aseptic rules are the same. The incision is, however, made with a bent iridectomy knife, and the *smallest possible* classical operation performed. The greatest care is made to replace the remnants of the iris, and if necessary the spatula is repeatedly employed till every shred lies within the anterior chamber.

In order to excise the iris with care and rapidity, the fixation forceps is handed to the assistant during this step. Afterwards the anterior capsule is divided horizontally with the triangular capsulotome just below the centre of the lens, and then vertically from the first incision. In this way we get a clear space directly opposite the centre of the cornea, there is less danger of subsequent occlusion, and better vision results than when the capsule is only divided in its upper portion. We have up to this time never attempted to remove a portion of the capsule with the forceps.

The field of operation is at this stage once more irrigated with the sublimate, and by soft pressure on the lower corneal margin with an india-rubber curette the lens is evacuated. In the same way any remnants of cortex are removed, but if they stick fast in the anterior chamber so that it would appear as if there were danger of loss of vitreous if pressed too hard to remove them, we leave them behind. Professor Horner used to press on the lid with the thumb in such circumstances, but Professor Haab does not now employ the procedure, as it may eject the contents of the Meibomian follicles into the incision, and he simply relies on the rubber spatula.

If blood or air have entered the anterior chamber, as often occurs in old persons after the use of cocaine, the flap is simply raised a few times with the spatula, the iris is carefully replaced, and the entire region once more irrigated with 1–2,000 sublimate solution.

A rapid test of vision is now made with the fingers, in order to reassure the patient, and then both eyes are bandaged with cotton soaked in the sublimate as above.

Although we rarely if ever operate on both eyes at one sitting yet both eyes are invariably bandaged, and only changed once in twenty-four hours for six to eight days, unless pain or great discomfort make a more frequent change a necessity. Whenever the bandage is changed great care is taken to cleanse the lids with the sublimate solution 1–2,000, and when the anterior chamber is restored, and especially if there are fragments of cortex left behind, atropine is instilled. If there was abundant secretion from the conjunctiva before the operation, we dust iodoform into the conjunctival sac and often with the happiest results in diminishing the secretions, and generally without producing the slightest irritation, or disturbing the rapid closure of the incision.

The chamber is kept moderately dark, and the patient is allowed considerable freedom in bed after the first day. Private patients are generally operated on in the same bed, in which they are to stay for the next few days, but in the hospital where the facilities are poor, we often have operated in the general operating room, and afterward laid the patients in the general ward with patients suffering from blennorrhoic and other infectious eye diseases without so far having but a single case of infection of the operated eye, a fact that speaks well for the thoroughness of the asepsis and of the advantages of care in the application of the same.

Although we believe that recovery is all the more rapid and all the smoother the quieter the patient is kept during the first few days, we know on the contrary from many cases that an eye operated aseptically and bandaged carefully and thoroughly can endure a great deal without any injury.

From the fifth or sixth day the unoperated eye is left uncovered *during the day.* In case the patient gets delirious, it is left uncovered at once. But up to the twelfth day the binocular bandage is carefully employed at night.

Great attention is paid to a strengthening and nourishing diet from the start. Wine or beer are not taken from those accustomed to them, or are even given in increased amount. It has, however, more than once occurred that notorious drinkers have only with the greatest difficulty been restrained from a hypocritical abstinence from liquor from a fear of not obtaining a good result.

It is well worth observing how rapidly the aged and those in apparently excellent health grow weaker day by day, even when the operation is going well. For that reason we have often been obliged to send patients home before the eye was thoroughly restored.

Although we have never seen a death from hypostatic pneumonia, yet we have often been obliged to remove the patients to their homes or the general hospital on account of a rapid decrease in strength, in which nostalgia plays a considerable rôle.

If the stomach or digestion is in bad condition before the performance of the operation, the latter is to be postponed for a while, and the digestion improved by proper treatment.

The period of treatment averaged from fourteen to eighteen days.

The final amount of vision was tested at various intervals (and at prolonged periods in the case of private patients), and the last amount found in the one entered in the registers, sometimes with and sometimes without the performance of a secondary operation on the capsule. In a few cases which were never seen after the first departure from the hospital the vision found at that time was entered, though it might possibly have been improved at a late date.

I.—Extraction of Simple or Slightly Complicated Senile Cataracts.

The 302 cases in this class are subdivided into those made (*A*) *with an iridectomy* (preliminary or during the extraction) and those made (*B*) *without an iridectomy.*

A.—Under this class we have 273 cases, of which 156, or 57 per cent., were operated upon privately, and 117, or 43 per cent., in the hospital. Forty-nine preliminary iridectomies were made.

Among the accidents of the extraction operation we find:

1. Loss of vitreous in 7 cases, but without any further injury to the sight or causing delay in the recovery. Cases with retraction of the vitreous during the extraction are not included.

2. Hemorrhage into the anterior chamber was observed 18 times.

3. The extraordinary number of 19 cases of striated opacities of the cornea was observed.

4. Iritis, more or less severe, with deposits on Descemet's membrane, was seen relatively often, and chiefly in eyes that had not previously been healthy, or in persons with diabetes and other diseases.

5. The section re-opened in five patients, though we were unable to decide whether this accident was due to the patient resting directly upon the eye, or to violent attacks of coughing, or to unknown reasons. In every case the recovery was good.

6. There was but one case of prolapse of iris during the recovery.

7. Glaucoma was seen in four patients at longer or shorter intervals after the operation.[1]

Secondary Operations.

A discission was made in 73 eyes. In 4 a second operation followed the first discission, and in one case there was an abrasion of the cornea. The largest number of discissions was made with two Bowman's needles, some with the Graefe knife, a few with the Graefe knife and a needle together, and in a few instances with one needle alone. The secondary operation was invariably done under cocaine anæsthesia and with the strictest observance of the most exact asepsis, whereby alone the great dangers of this minute yet indispensable operation are most largely avoided. Great care nevertheless is necessary lest we meet with the accidental prolapse of very fine threads of vitreous which we observe in some cases with the withdrawal of the needle and in others at a later date. These are to be snipped off with de Wecker's scissors, or touched with the galvano-cautery, after which we have a rapid recovery.

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[1] One case of croupous pneumonia on the nineteenth day; transferred to the internal clinique.

The proportional rarity of the performance of discission of the capsule in our cases shows the greater advantage of the combined over the simple extraction of cataract. For whereas we had but 26% of such cases in 273 eyes, Prof. Knapp acknowledges 54% in one series of a hundred simple extractions, 74% in a second hundred, and 53% in a third hundred, thus showing an average of over 60%. And further still, as Prof. Haab always does discission whenever there is a reasonable probability that it will result in an improvement of the sight, and Prof. Knapp operates with the same intentions, it is plain that the reason for double the number of secondary operations performed by Prof. Knapp depends entirely upon the method of operating chosen.

The following tables show the visual results before and after the secondary operation of discission.

1. Final vision WITHOUT discission of the capsule.

Of the 273 eyes in series *A*, 200 recovered without any further operation, and we find the following results:

Vision	equals	1	in	39	cases,	or	14.39	per	cent.
“	“	$\frac{3}{4}$	“	25	“	“	9.15	“	“
“	“	$\frac{3}{5}$	“	25	“	“	9.15	“	“
“	“	$\frac{1}{2}$	“	32	“	“	11.72	“	“
“	“	$\frac{1}{3}$	“	35	“	“	12.82	“	“
“	“	$\frac{1}{4}$	“	20	“	“	7.32	“	“
“	“	$\frac{1}{5}$	“	2	“	“	9.72	“	“
“	“	$\frac{1}{6}$	“	10	“	“	3.64	“	“
“	“	$\frac{1}{7}$	“	1	case	“	0.36	“	“
“	“	$\frac{1}{8}$	“	3	“	“	1.19	“	“
“	“	$\frac{1}{10}$	“	5	“	“	1.82	“	“
“	“	$\frac{1}{60}$	“	1	case	“	0.36	“	“
Perception	of	light	in	1	case,	or	0.36	per	cent.
Vision nothing			“	1	“	“	0.36	“	“

Following the usual subdivision of vision 1 to $\frac{1}{10}$ as perfect success, we have 197 cases or 72 per cent.

Vision from $\frac{1}{10}$ to $\frac{1}{1000}$ 2 cases, or less than 1 per cent.

Vision 0 or total loss, 1 case, or less than one half of 1 per cent.

2. Final vision WITH secondary operations.

Seventy-three patients were thus operated upon with the result of increasing the vision to 1 in 16 cases, to $\frac{3}{4}$ in 17, to $\frac{3}{5}$ in 11, to $\frac{1}{2}$ in 10, and from $\frac{1}{3}$ to $\frac{1}{20}$ in the remainder.

If we collect all the statistics *before and after* the secondary operation we have:

Vision equals	1	in	55	cases,	or	20	per	cent.
“ “	$\frac{3}{4}$	“	42	“	“	15	“	“
“ “	$\frac{3}{5}$	“	36	“	“	13	“	“
“ “	$\frac{1}{2}$	“	42	“	“	16	“	“
“ “	$\frac{1}{3}$	“	43	“	“	16	“	“
“ “	$\frac{1}{4}$	“	27	“	“	10	“	“
“ “	$\frac{1}{6}$	“	12	“	“	4	“	“
“ “	$\frac{1}{7}$ to $\frac{1}{10}$	“	12	“	“	4	“	“
“ “	$\frac{1}{20}$	“	1	case	“	0.36	“	“
“ “	$\frac{1}{60}$	“	1	“	“	0.36	“	“
Light perception		in	1	case,	or	0.36	“	“
Total loss		“	1	“	“	0 36	“	“

If we unite all of the cases and divide them into good, moderate, and failures, we have the following list:

Successes in 175 cases, moderate results in 94 cases, bad results in 3 cases, and total failure in a single case.

Or, once more, calculating all of the cases with vision from 1 to $\frac{1}{10}$ we have nearly 99 per cent. of successes, 1 per cent. of poor results, and about one third of 1 per cent. losses.

The single case of total failure was due to the patient alone, for he was very restless, tore off his bandage, and was very unruly from the day of the operation. The panophthalmitis broke out on the fourth day, apparently due to infection from the patient's fingers. The other eye was, however, operated upon with success at a later date, and with good results, the patient being carefully watched day and night after the operation till the eye could be uncovered, when a perfect result was found to have been obtained.

There is not a single instance in our list of an eye being lost at a later date from insidious irido-cyclitis, or from any other disease that could be referred to infection at the time of the operation, or that could in any reasonable manner be referred to the operation itself. For cases of glaucoma appearing sooner or later, by means of which a good result from the operation was reduced or even destroyed, or metastatic choroiditis which breaks out long after a normal recovery, cannot be ascribed to the operation, at least when made with an iridectomy.

Sum up the whole matter as one will, it is my opinion, based on Professor Haab's material, *that simple extraction is not the best nor is it the safest method of extracting cataracts. On the contrary, the combined extraction when thorough antiseptic methods are rigorously enforced, shows fewer total losses, and a relatively better amount of sight than the simple extraction.*

Referring to the opinion expressed by the supporters of simple extraction, that it is to be performed *eclectically*, so that in given cases of complications, or where one eye is already lost, etc., or when we wish the greatest possible security, the combined method is to be preferred, I simply point at the disadvantages of the simple extraction, iris prolapse, etc.

B.—Simple Extractions without Iridectomy.

During the year 1890 Professor Haab made 29 extractions without iridectomy. The section was made upward with a Graefe knife 2 *mm* within the limbus corneæ and with a flap equal to one-third to two-fifths of the corneal diameter.

Any definite opinion concerning the advantages or disadvantages of this method, or in regard to the amount of sight regained, must be postponed to a future time, as the number of cases is still too small at present.

II.—Lamellar Cataract.

The 56 cataracts operated upon under this title belonged to 31 patients, and three operated upon by extraction are not included in the list at all.

Fully a third of the patients suffered from gout, arthritis in various forms, more than half of them from rhachitis, and fully two-thirds were below the average of intelligence.

Method of Operation.

Iridectomy was performed eighteen times, but only three times for purely optical purposes, and the result was so unsatisfactory that the operation was not pursued in the clinique. The majority of the iridectomies were made for the purpose of reducing rapid increase in tension from swelling of the lens, or where the pupil did not satisfactorily dilate under the exhibition of atropine. Latterly, however, we have operated without iridectomy, and so far without witnessing any unfavorable results. The pupil is dilated *ad maximum* with atropine, and then under cocaine-anæsthesia, and with the most careful asepsis the capsule is divided, and not too freely, with the narrow Graefe knife. If the lens swells rapidly and violently we resort to the use of ice-bags and rest in bed, or, if absolutely necessary, paracentesis of the cornea is made without delay, and repeated if necessary. In doing this we employ a narrow, bent knife and a narrow spatula for pressing open the incision. If more than one discission is needed it is generally done with the needle.

In all 129 discissions were made, seven in one case. Paracentesis was performed 41 times. There were no threatening symptoms in any case. In one case only, a badly nourished patient from the country, the recovery was extremely slow and there were repeated attacks of iritis serosa, all of which, evidently due to anæmia, were finally relieved without doing any damage to the eye.

Vision of 1 was obtained in 15 cases, or 26.78 per cent.; from $\frac{3}{4}$ to $\frac{3}{8}$ in 29 cases, or 52 per cent.; from $\frac{1}{4}$ to $\frac{1}{20}$ in 11 cases, and one case had only slight perception of light.

III.—Congenital Cataract.

In this class there were eleven operations in nine patients. In three, the operation was performed with iridectomy, in all the rest discission with the needle or narrow knife. The final visual result after subsequent discissions (in four cases) was perfect in one, moderate in four, and in the rest the operation had been performed for cosmetic effects alone, the visual fields being imperfect from the first presentation of the patients.

IV.—Complicated Cataracts.

In this class there were 16 extractions on men and 21 on women. In all, the greatest watchfulness in regard to asepsis was observed. In 23 patients a preliminary iridectomy was performed owing to the presence of iritic adhesions or fluid vitreous or other complications. In 10 cases there was extensive loss of vitreous at the time of extraction. In a majority the lens had to be extracted with a spoon, or with a silver-wire loop which Professor Haab seems now to regard as superior to any spoon of solid metal.

Some of the patients had been refused an operation at other cliniques, but in most of these we were glad to observe an encouraging increase of vision after the operation. The visual results, taking all in all, were small.

One quarter of all the patients recovered no sight at all, and of the remainder there were two or three who got $\frac{1}{2}$ or $\frac{1}{3}$, whilst the remainder varied from that to $\frac{1}{20}$.

Some of these patients obtained still better sight after subsequent discission, and I should not forget to insist that in a few cases the extraction was done for cosmetic purposes alone.

Among interesting notes on this class of patients I find the case of a man with a history of optic atrophy from specific infection, with narrow field and incipient cataract, in whom at a later date, after inunction, a preliminary iridectomy was performed for maturation of the cataract. Three months after this latter operation, extraction was done with the spoon, and later, after discission, vision was brought up to $\frac{1}{2}$, though the field remained affected.

Another case was one of amaurosis after a fall on the occiput. Later still the patient was hit violently on the head with a club. When he regained consciousness he had loss of sight from hemorrhage into the retina, as he was informed by an ophthalmic surgeon whom he saw at the time. The extraction of the lens, immature when he consulted Professor Haab, was accomplished with iridectomy, and the sight as tested after the operation was good, but unfortunately the eye was hit on the second night afterwards, resulting in hemorrhage into the anterior chamber, gradual diminution of sight to perception of light, and finally blindness.

In a third case there was hemorrhage from the vitreous (possibly too from the choroid) on the third day, with clots of blood visible in the vitreous for months afterward. Still the patient could see $\frac{1}{10}$.

In several of the cases of complicated cataract the patients were subjected to a prolonged preliminary inunction, and apparently with much benefit, prior to the extraction of the lens.

The list further includes a case of detachment of the retina as diagnosticated before the operation, but with good perception of light in parts of the field. Tension was also reduced and pterygium was present. This was not treated. The result was good, in that the vision was better after the extraction than before.

One of the most interesting cases was one in which a preliminary iridectomy was made for increased tension. During the extraction the patient compressed the eyelids so that the vitreous extruded *before the lens was extracted*. Extraction with a spoon, but so abundant a loss of vitreous that the cornea collapsed and could not be made out as a structure of the eye. In a few minutes, however, the globe regained its shape and the ultimate result was good, Snellen viii being read with a proper lens.

Another patient exhibited disseminated patches in the choroid many years before, and as was to be expected, but little sight was regained. The whole list is characterized by cases really unfit for operation, and in which it was done simply in the hope of doing something for a large number of unfortunate creatures.

GLAUCOMA EXPERIMENTALLY PRODUCED IN RABBITS.

BY PROF. RICHARD ULRICH, OF STRASSBURG.

Translated by CHARLES H. MAY, M.D., New York.

MY studies in glaucoma having led me to regard the iris as the principal and causative factor in the production of hyperæmia and hypersecretion of the ciliary processes, I did not neglect to verify the results obtained from the examinations of the irides of enucleated eyeballs by comparison with the excised pieces of iridectomies in recent cases of glaucoma.

These investigations were published in 1882.[1] The results which can be described briefly as fibrous condensation of the iris tissue with obliterating vascular changes, were subsequently corroborated a number of times, partly through examination of excised pieces of iris,[2] partly through the study of enucleated glaucomatous eyeballs.[3] An opportunity for verification presented itself through the examination of two glaucomatous eyeballs removed from a cadaver.[4] I became convinced of the necessity of using only fresh material in studying the pathogenesis of glaucoma; and hence as early as ten years ago, I thought of the experimental production of glaucoma in animals for this purpose.

For obvious reasons, my experiments were directed towards the production of secondary glaucoma, the etiology of which is apparently plain; the two principal forms following anterior and posterior synechiæ did not seem to present too much difficulty in demonstrating the existence of primary disease; I selected glaucoma after leucoma adherens, because the development of this form did not seem as ambiguous as other varieties of secondary glaucoma.

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[1] *v. Graefe's Archiv*, Bd. xxviii., 2.

[2] *Die Veränderung des Iris-Gewebes bei verschiedenen Augenerkrankungen.* Inaug. Diss. v. Georg Heyne, Konigsberg, 1884.

[3] Birnbacher und Czermak, *v. Graefe's Arch.*, Bd. xxxii., 2.

[4] "Studien uber die Pathogenese des Glaucoms," *v. Graefe's Arch.*, Bd. xxx., 4.

The increased tension following chronic iritis with circular synechia may be explained in two ways: The retention theory believes it to be due to separation of the anterior from the posterior chamber; the secretion theory, which I advanced, considers it due to marked fibrous degeneration of the iris, sclerotic changes in the walls of the blood-vessels, and pigment-thrombosis—all of which changes, described by myself, and by Heyne, must lead to disturbances in the circulation of the blood in the iris and ciliary body. In cases of glaucoma following leucoma adherens, the retention theory is as applicable as when total posterior synechia occurs.

My first experiments in causing secondary glaucoma from leucoma adherens were done in 1882.[1] But although I succeeded in producing a perforating ulcer of the cornea in a rabbit by means of a pointed stick of nitrate of silver, and a considerable portion of the iris became incarcerated, there was no appreciable increase of tension during a period of observation lasting a year and a half. I was led to resume the experiments in somewhat modified form in 1887, by a clinical observation already reported,[2] the details of which I shall repeat briefly, since they are of importance in considering the much-discussed question of retention or secretion theory.

On the 1st of May, 1887, a case of gonorrhœal conjunctivitis came under my care; there had been rapid and total necrosis of the cornea, the iris becoming adherent to lens capsule in a condition of extreme myosis and the narrow pupil obliterated by exudation. As there was complete loss of cornea, the iris had to bear the intraocular pressure and there was bulging at two points requiring incision. In the course of four weeks, smooth healing with the iris in its normal position resulted, and there was no doubt of an adhesive connection between iris and lens capsule. According to the retention theory we ought to have had glaucoma; but instead, after observation for five months, the eye showed excellent perception of light, a good field and normal tension. The iris, free and exposed to the air, constantly became more fibrous in character through the growth of white connective tissue in its substance; when this fibrous degeneration had reached a certain point (in Dec. 1887) glaucoma set in.

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[1] *v. Graefe's Arch.*, Bd. xxx., 4, p. 274.

[2] Ophthalmologische Versammlung zu Heidelberg, 1891.

It must be very difficult for the believers in the retention theory to explain how an eye, with apparently normal secretion during five months, could preserve normal tension, with the contents of the vitreous and the posterior chambers completely separated from the chief exit in the iris angle—a difficulty of explanation which, by the way, exists quite often in typical cases of secondary glaucoma in which increased tension follows the occurrence of posterior ring synechia only after the lapse of years. Hence in the fall of 1887, I determined to renew the experimental attempts to produce glaucoma in animals, with the idea of converting the normal spongy, vascular iris into an atrophic and sclerotic membrane so as to produce the greatest possible amount of vascular obliteration.

At first I performed total excision of the cornea in two animals; but in one there followed panophthalmitis, and in the other an uncontrollable granuloma upon an extensive prolapse of the iris. Next, I distributed the excisions, removing successive quadrants of the cornea extending to the pupil, allowing each defect to heal with an adherent iris before the next operation; segments of natural cornea were allowed to remain between the excised portions. The iris showed a tendency to loosen itself from its adhesion to the corneal cicatrices; so I closed the lids with a single suture corresponding as closely as possible to the seat of excision. This enabled me to keep the lids closed for two weeks, to watch the eye, to remove secretions, and to give support to the exposed iris. By means of this procedure I succeeded in effecting multiple excisions of the cornea in eleven cases, each with more or less extensive adhesion of the iris to the corneal scar—in ten cases without any marked change in the corneal curvature, in one case with total staphyloma.

Four of these cases developed a well marked secondary glaucoma, with appreciable and constant increase in intraocular tension; in five cases increase of tension was doubtful or inconstant; in two cases the operated eyeballs became soft.

The four successful cases of secondary glaucoma (detailed description is omitted) showed great similarity in course and in anatomical examination. There could be no doubt of the existence of real secondary glaucoma analogous to that which is observed in man. From one month to three months after the artificial production of leucoma there followed acute and distinctly appreciable increase of tension, sometimes accompanied by hemorrhages into the corneal cicatrix and partial bulging of the latter, and the eyeball seemed increased in size as compared with the opposite one.

In regard to the anatomical examination, the following are the important points as far as they relate to the production of glaucoma:

In all four cases there were extensive anterior synechiæ, especially of the pupillary portion of the iris. The histological changes of the iris consisted in fibrous sclerosis and atrophy; the latter had reached such a degree in portions that we could assume that blood-vessels must have become obliterated; on the other hand, there were areas, especially in the pupillary portion, which showed dilatation of the blood-vessels. The anterior chamber and Fontana's spaces were more or less contracted or obliterated. Most of the ciliary processes appeared hyperæmic. There were pigmentary deposits, especially in the neighborhood of the blood-vessels, and there was also pigment in the blood-vessels (pigment-thrombosis). The vitreous was infiltrated with albuminous fluid, especially in one of the cases. Retina, choroid, and vasæ vortic. negative.

Two very important points observed during life may be noted here: first, the early occurrence of hyperæmia of the ciliary processes, and, second, the simultaneous occurrence with this hyperæmia of hypersecretion of aqueous humor as demonstrated by subcutaneous injection of fluorescin. It is also interesting to note that in several cases the advent of glaucoma was accompanied by visible hemorrhages into the leucoma, and in the other cases traces of old hemorrhages were found when the corneal cicatrices were examined.

The facts just mentioned easily explain the occurrence of increased tension.

Besides these four cases there were four others which resulted negatively, though done apparently under the same circumstances; there was no appreciable increase of tension following the adhesion of the iris. Since negative results are often of value when considered in connection with positive data, a brief description is given. These cases (5, 6, 7, and 8) were observed for five to ten months, during which time successive exsections of pieces of cornea were done. At the end of these periods of observation the animals were killed. The microscopical examination showed incomplete adhesions of iris to cornea, and especially a freedom of the margin of the iris.

These cases (5–8) were observed much longer than the first four cases, with the expectation that increased tension would show itself. Hypersecretion of the ciliary processes could be demonstrated by the fluorescin method; but this hypersecretion certainly did not lead to an appreciable increase of tension. Hence it was important to search for anatomical differences, which, however slight, might explain the variation in course during life. Two such differences were found in comparing the anatomical examinations of cases 1–4 with cases 5–8: 1. The pupillary portion of the iris was less adherent in the second group of cases than in the first; 2. there was less deposit of pigment in the ciliary processes.

Remembering the observations during life and adding the positive and negative points of the anatomical examination, it is not difficult to explain the pathogenesis of secondary glaucoma experimentally produced in animals.

The immediate effect of an extensive incarceration of the iris in the corneal defect is besides the mechanical imprisonment, traction upon the iris and the corresponding part of the ciliary body and partial narrowing of the anterior chamber and Fontana's spaces. We notice an immediate hyperæmia of the ciliary processes and an increased production of aqueous humor. The mechanical incarceration of iris tissue acts directly, and the secondary fibrous degeneration and atrophy act indirectly to produce disturbances of the circulation in the iris.

My experiments in animals have convinced me that incarceration of the pupillary portion of the iris produces glaucoma more readily than peripheric incarcerations. The reason for this seems to be that the former encloses a larger vascular area than the latter.

The pigment infiltration of the ciliary processes may be regarded as an important symptom of chronic hyperæmia of these parts, showing the existence of a long-continued process associated with stagnation; hence in the second group of cases no such marked hyperæmia existed.

The facts just mentioned ought to suffice in explaining the rationale of the production of glaucoma in these animals. Immediately following the incarceration of the iris in the corneal scar there was chronic hyperæmia of the ciliary processes; this caused pigmentary deposits in the tissue of the processes and also hypersecretion of the aqueous, the demonstration of which scarcely required the use of fluorescin. This hypersecretion is the fundamental factor in the production of glaucoma, and accordingly, the entire theory is a secretion theory, the same that I advanced in 1884, explaining ordinary inflammatory glaucoma as well as the two principal forms of secondary glaucoma in man. Impeded permeability of the anterior chamber may be an accessory cause.

ON INTRAOCULAR CYSTS.

By Dr. RICHARD GREEFF, Frankfort-on-the-Main.

Translated by Dr. Ward A. Holden.

(*With Plates VIII. and IX., vol. xxv., German edition.*)

ALTHOUGH clinical descriptions of cases of intraocular cyst are common enough in the literature, there are many points touching the nature and genesis of these cysts that are still in doubt. We have begun to have a clearer idea of them since an attempt was made to classify them as to their structure and location, and since we have ceased to regard the genesis as the same in all cases, and to explain them all by the same theory.

As regards the structure of the cysts, the best classification is the earlier one of Hulke (*Royal London Ophth. Hosp. Rep.*, 1867, vol. vi., p. 12), which distinguished;

1. Thin-walled membranous cysts with epithelial lining and clear fluid contents;
2. Thick-walled cysts with opaque, thick contents;
3. Solid cysts, consisting of a collection of epithelium;
4. Cysts composed of myxomatous tissue.

We recognize that in this classification have been included as cysts two forms of tumor of widely different anatomical structure, those with a firm wall and fluid contents, and those of uniform consistency. The two have only similarity of appearance, origin, and character, in common (de Wecker, Graefe-Saemisch, vol. iv., p. 540).

We might better call

No. 1 and No. 2 "true cysts."
No. 3 and No. 4 "false cysts."

The chief point in the pathogenesis of the intraocular cysts lies in distinguishing whether in a given case we have to do with a tumor which has arisen from the implantation of èpiblastic tissue in the mesoblast, or which has arisen directly from the mesoblast. Treacher Collins calls the cysts which have originated in the former manner epithelial cysts, and those originating in the latter endothelial cysts.

The observation that an injury almost always precedes the formation of an intraocular cyst, and further that cilia and epidermic scales in the eye give rise to growths and small tumors first led pathologists to consider the intraocular cysts as epithelial or implantation tumors (theory of Buhl-Rothmund). What these authors found clinically and microscopically was proved for the solid or false ocular cysts by experiments on animals (Dooremal, Goldzieher, Masse, Schweninger, Hosch, etc.). Through the injury small particles of epidermis or of glands are carried into the eye, where they form solid tumors composed of concentric layers of epithelial cells, called epidermoidoma by Rothmund, epithelial pearl tumors by Monayer, or cholesteatoma rather than cysts.

These epithelial particles are carried mostly into the iris, where they appear clinically as small yellowish pearly tumors.

Experiments show that at times serous cysts also may be due to implantation. For this there is required only the passage of any foreign body into the eye, while for the production of a sebaceous cyst Hosch supposes the entrance of a gland to be necessary. According to Masse's experiments, the entrance of corneal epithelium may cause either false or true cysts of the iris.

It is not always necessary that there be a perforating wound, for cysts have been seen to arise from the scratching of the cornea with a pin or the finger-nail. Bland Sutton had described such implantation cysts, which were taken to be dermoid cysts of the limbus, and which appeared after trivial injuries in this region.

Not infrequently small vesicles or cysts appear on the surface of the cornea, but these are of a different character and have another genesis. These are small elevations of the cornea found in staphylomatous and glaucomatous eyes. Collins examined such microscopically. "There is a slight infiltration of round cells between the anterior layers of the cornea. The epithelium shows a number of cystic cavities mostly of oval shape and of varying size. Some of these cysts have broken through their anterior wall and open on the surface. They are all separated from the membrane of Bowman by a layer of cells."

We must assume these cysts to represent the final outcome of the condition which Fuchs has described as the cause of the corneal opacity in glaucoma.

Among the epiblastic cysts are the rare implantation-cysts in the corneal substance. Alt has described four such. All arose after an injury; in two the walls of the cyst showed uveal pigment, which led the author to the conclusion that by the injury uveal pigment had been carried into the cornea, and proliferating had destroyed and displaced the surrounding tissue.

Collins has lately reported two interesting cases of this sort. The first was an epithelial implantation-cyst in the cornea after a perforating shot-wound, the second a similar cyst after a cataract extraction. The author supposed that in each case epithelial cells had been carried into the substance of the cornea at the time of the injury. By their proliferation the cells lying between them were compressed, broken up, and finally absorbed.

The greater number of ocular cysts arise from the tissue of the iris. They are found on the anterior surface, in the substance of the iris, and arising from the posterior pigment layer. They are situated on the pupillary margin as well as in the iris angle.

A number of these cysts may be explained by the Buhl-Rothmund theory, particularly those in the second category of Hulke's classification, the epithelial cysts of Collins. Here belongs the case described by Graefe, in which the cyst contained short hairs and sebaceous matter.

A case reported by Feuer shows that the Buhl-Rothmund theory is applicable to many serous cysts: "In numerous preparations one saw a section of the normal iris, which, when followed further, divided into two portions, the angle between the two being lined with a many-layered epithelium, somewhat similar to the corneal epithelium."

In the late literature Stölting reports two interesting cases, and, on the ground of his microscopic examination, adheres to the above theory. He assumes an inoculation of corneal or conjunctival epithelium into the iris through the wound.

In opposition to this theory stand the cysts whose development has not been preceded by injury or perforation of the cornea, the so-called spontaneous or idiopathic cysts of the iris, which arise from mesoblastic tissue purely. These cysts, whose existence was formerly doubted by adherents of the theory, have been frequently observed of late. Such cases have been reported by Schröder and Schmidt-Rimpler. The latter author has endeavored to give a satisfactory account of the development of these spontaneous serous cysts, by supposing them to be due to a closure of one of the crypts which Fuchs describes as normally present on the anterior surface of the iris. According to Fuchs these depressions extend down to the vessels, and the latter send their lymph through them to the anterior chamber. Masses of tissue and small, non-nucleated membranes spread over these crypts. "If now, in pathological conditions, a membrane of this sort becomes thickened so that the iris tissue is completely cut off anteriorly from the anterior chamber, the lymph increases, and distends the original depression." This view has the merit of explaining the endothelial lining of the iris cysts.

Collins, adhering to Schmidt-Rimpler's theory, reported two further cases of idiopathic iris cysts.

Herrnheiser also reported a case, but did not accept Schmidt-Rimpler's theory as proven.

Lately the theory of Eversbusch has been favorably received. He believes that from some injury a hemorrhage takes place at the iris angle, causing distension and detachment of the ligamentum pectinatum and the anterior and middle layers of iris tissue. Through transudation from the circulus anterior iridis major a cyst forms in the loosened tissues, which gradually enlarges at the expense of the iris and the cornea. Gayet and Hanemann have supported this theory.

Quaita observed a cyst nine months after extraction of a cataract. Microscopically the corneal epithelium was found to have grown over upon the iris.

Among the spontaneous cysts should be included the rare cases of congenital cyst, which may be explained in accordance with Everbusch's theory. Until we have further information, we may assume that a lesion of the eye is produced at birth, causing hemorrhage at the angle of the anterior chamber.

Other varieties of cyst have been described lately by Collins. One was in the anterior chamber, a second between the pigment layers of the iris, and a third on the posterior surface of the iris.

A peculiar case was observed by Critchett. A portion of the cyst projected into the anterior chamber, and a portion lay beneath the conjunctiva.

When we take into consideration the many theories advanced to account for the origin of the serous cysts, all of which are more or less probable, and the manifold nature of the cases reported, we may safely conclude that no one theory is capable of explaining all the cases.

In general we may say that the thin-walled cysts lined with a single layer of endothelium are not implantation cysts, but endothelial cysts originating in and from mesoblastic tissue only.

The following interesting case, the eye being enucleated in the Berlin university clinic and given to me for examination by Professor Schweigger, cannot be considered as having arisen by implantation.

Multiple cysts of the ciliary body after cataract extraction, with consecutive chronic choroiditis.

G. H., æt. forty-two, was injured with splinters of iron in the left eye in 1882. One splinter was said to have been removed, another remained in the eye. Vision gradually grew worse.

Jan. 14, 1884, the patient was examined by Professor Schöler. R normal, $V = \frac{20}{20}$; L cataracta mollis traumatica. Perception of light good, projection outward poor. Extraction was made, resulting vision $\frac{15}{200}$, Snellen VII.

Downward and outward in the periphery of the vitreous is a grayish-white mass (foreign body) with neighboring inflammatory changes. Remainder of vitreous cloudy. Disc indistinctly seen.

Two *mm* outward and downward from the limbus corneæ is a small bluish-black spot in the sclera, where, according to the patient's statement, the foreign body entered. The visual field shows a defect upward and outward extending nearly to the point of fixation.

March, 1889, the patient came to the Berlin clinic saying the sight of the left eye was failing and the eye had been inflamed.

The cornea is slightly cloudy, and there is some perikeratic injection. The anterior chamber is shallow; the iris is pushed forward, irresponsive, greenish-gray in color, containing little pigment, and atrophic. Upward and outward is a broad coloboma including one third of the iris. Pupil and coloboma are almost completely filled with a dark tumor, which apparently springs from the pigment layer of the iris. By lateral illumination the tumor appears translucent, suggesting rather a cyst than a compact tumor. $V = O$, tension reduced, ball sensitive to pressure, mobility normal.

March 14, 1889, the ball was enucleated. Its posterior surface showed a number of shallow linear depressions, and appeared shrunken and small.

After hardening in Erlitzki's fluid and alcohol the ball was cut in horizontal sections. No foreign body was found.

Fig. 1 represents one of the sections. The cornea is fairly normal excepting the operation scar.

Just behind the cornea (Fig. 1) are two thin-walled cysts with transparent contents. Behind the cysts is a remnant of the vitreous. The posterior two-thirds of the ball is filled with a tumor-like mass with numerous pigment deposits. In the upper segment of the ball the large cyst to the right is not seen and the small one to the left is larger (Fig. 2). Between this latter cyst and the cornea a portion of the iris remains, the anterior surface adherent to the cornea, the posterior surface loosely attached to the cyst. This cyst does not come in contact with the cornea, but extends along the posterior surface of the iris and is adherent to the ciliary body. Behind the cyst lies a remnant of the lens with its capsule and the zonula. Behind the lens lies shrunken but transparent vitreous. No trace of the retina can be found. On the opposite side the remainder of the iris lies directly behind the cornea and is adherent to it. The anterior margin of the iris lies at the end of the corneal scar, but has not healed into it.

Microscopic.—The scar extends through the cornea almost transversely. The middle lamellæ have united. The spaces between the cut anterior and posterior lamellæ are filled with epithelium or endothelium. There is also in the wound canal a new vascular fibrous tissue. Descemet's membrane has not reunited.

The margin of the iris has not healed into the corneal wound. The iris angle is adherent to the cornea. The endothelium of the cornea and of the iris is normal. The iris and ciliary body are atrophic.

The relations are somewhat different on the other side where the cyst has its origin (Fig. 2, left). The infiltrated iris lies on the cornea. The middle layers of the iris are thickened by connective-tissue proliferation. The pigment layer is but slightly thickened. Adjoining the pigment layer is the pigment layer of the cyst, which extends backward and inward along the ciliary body. The ciliary body is atrophic, the muscle being scarcely visible, the processes compressed. The pars ciliaris retinæ cannot be recognized.

The cyst itself is lined with a single layer of endothelial cells. The outer wall is composed of pigmented atrophic uveal tissue. The tumor-like mass in the posterior portion of the ball is composed of different elements. Its production would seem to have been as follows: Cyclitic membranes formed in the vitreous, and shrinking detached the retina totally and the choroid partially, separating it into layers, the intervening spaces being filled with fluid. All these tissues have been distorted and altered by the traction of new-formed connective tissue, and have finally become so degenerated as to be almost unrecognizable, and here and there bony deposits have been formed.

The cyst simply rests on the iris, but is inseparably connected with the ciliary body. We have then in this case cysts of the ciliary body.

The development of serous cysts of the ciliary body has been described by Kuhnt. He frequently found them as a senile change in eyes in which the ciliary body was altered by atrophic processes. These cysts appear most frequently on the portion of the ciliary body next the ora serrata. They arise from the detachment of the pars ciliaris retinæ or of the pigment epithelium. The atrophic processes in the vascular portion of the ciliary body are the cause of the transudation and the resulting cystoid formations. The smaller cysts, becoming confluent, form a larger one (Kuhnt).

In the present case we have no senile changes, but changes consecutive to the atrophy of the ciliary body following the clinically-observed irido-cyclitis. In order to understand the development of these cysts, we should recall the experiments and theories of Nicati. He assumes that the fluid secreted by the chorio-capillaris is excreted by the ciliary processes. When, as in our case, in all probability an adhesion forms between two ciliary processes, or between a ciliary process and the iris, the fluid secreted cannot flow into the anterior chamber, and the formation of cysts and the serous infiltration of the choroid is the natural consequence. Here the entire ciliary body has been detached, and between sclera and ciliary body a quantity of fluid has been poured out. Such pathological conditions speak in favor of Nicati's views.

The development of the changes found was probably as follows: After the extraction of the traumatic cataract a slow irido-cyclitis led to adhesions between the ciliary processes or between a ciliary process and the ciliary body. In this way closed cavities were formed, into which fluid secreted by the chorio-capillaris was poured continuously, so that gradually three large cysts developed. The original cylindrical epithelium of the adherent ciliary processes became, through the growth of the cyst, a simple layer of flat cells. The cysts prevented the exit of the aqueous humor through Fontana's spaces and the lymph channels of that region, thus causing a stasis in the choroid itself of the transudation from the chorio-capillaris.

With the irido-cyclitis an abscess developed in the vitreous. This led to detachment, and later to degeneration of the retina.

In this case the diagnosis of cyst was made with the ophthalmoscope. This is not always possible, and a melanosarcoma may be mistaken for a cyst. In cases in which enucleation is not definitely indicated, the diagnosis might be confirmed by puncture of the tumor through the sclera.

In a doubtful case, with immature cataract and a black tumor behind it, Collins removed the cataract, and made an iridectomy at the seat of the tumor. The tumor collapsed when the iris was seized with the forceps, and microscopic examination of the excised portion showed that there was a cyst of the posterior pigment layer of the iris. The eye was not enucleated, and vision was restored.

Cysts in the vitreous are very rare. Knapp has described such a case. Six years after the successful removal of a foreign body from the vitreous a cyst was found at the same spot. These cysts are to be regarded as produced by the implantation of epithelium.

Passing to the cysts of the retina, we should first mention cystoid degeneration of the anterior segment. In senile eyes small cystic cavities are often found among the elongated and thickened Müller's fibres. Less frequently larger, currant-like cysts are found in the posterior segment of the detached retina. A case of this variety was examined in the Berlin university eye clinic.

Multiple large cysts in the funnel-shaped, detached retina.

Patient always myopic, and vision poor. In May, 1887, vision began to grow worse, and he became totally blind. In December, 1888, the right eye suddenly became inflamed, and he was sent to the university eye clinic.

St. pr.—R. eye strab. divergens et deorsum vergens. Cornea hazy, perikeratic injection, photophobia. The anterior chamber occupied by a red body, similar in appearance to a dislocated lens. L. hypermature cataract.

An attempt was made to extract the body, which appeared to be the lens. After the corneal incision blood escaped from the anterior chamber, and after manipulation fluid vitreous. The operation was not continued.

The anterior chamber soon filled with blood again, and February 22d the eye was enucleated. After hardening in Erlitzky's fluid, the ball was divided horizontally, embedded in celloidin, and cut in sections.

The form of the cornea is normal. The entire anterior segment of the ball is filled with blood, in which is the shrunken and dislocated lens. The retina is detached from the optic disc to the ora serrata. At many points the retina is much thickened. On the outer side of the retina are five small cysts with clear contents.

Fig. 3 represents a horizontal section of the posterior segment. To the left is a large cyst, springing from the outer portion of the retina. Within the retinal funnel is a second, the origin of which from the outer portion of the retina is obscured by the folds. Anteriorly to the right a portion of a third cyst is seen.

The case is similar to that pictured by Leber in vol. v. of Graefe-Saemisch.

Microscopically we find the usual degenerated, partially atrophic, partially hyperplastic, detached retina. The pigment epithelium is hypertrophied at some points. The vessels are sclerotic and many of them are obliterated.

The two reticular and the two nuclear layers may still be recognized, Fig. 4. The other layers are replaced by interstitial connective tissue, with diffuse cellular infiltration. On the inner side of the retina is a thick layer of reticular connective tissue. The rod and cones are not recognizable. Numerous small round cavities are found in the nuclear and internuclear layers.

Fig. 4 represents a portion of the retina that is fairly well preserved. In the upper part is seen the beginning of a cyst wall, composed of the outer nuclear and the internuclear layers, the inner granular layer remaining unchanged and in position. The walls of the other cysts are similar.

The small round cavities in the retina, the so-called cystoid degeneration or œdema of the retina, is found in old age (Iwanoff, Merkel), in detachment of the retina, in secondary glaucoma, after injuries, etc. Merkel found the cavities more frequently in the outer nuclear layer, and less frequently in the inner; Kuhnt found them in the nuclear, ganglion-cell, and nerve-fibre layers.

An œdema of the retina always precedes the formation of cysts. From the confluence of a number of the smaller cavities large cysts are formed.

Iwanoff supposed œdema of the retina to be due to chalky degeneration of the retinal capillaries. Collins believes that when a detachment of the retina has preceded, the primary cause of the lymph stasis in the retina is to be found in changes in the end of the optic nerve. The vessels of the papilla run out into the retina only and do not anastomose with the choroidal vessels. If we have a swelling of the papilla, the thin-walled veins with their lymph sheaths will be compressed, while the arteries still carry blood into the retina. The result of this is a stasis in the retina.

In both the cases here reported there was a transudation into a closed cavity. In the first case the fluid came from the chorio-capillaris, in the second from the retina.

While cysts of the iris and ciliary body may often be seen with the ophthalmoscope, retinal cysts are rarely discovered. The media are generally hazy. One case has been described by Panas and one by Collins.

LATER LITERATURE.

The earlier literature may be found in Graefe-Saemisch, vol. iv.

MASSE, Nouvelles expériences sur les greffes iriennes destinées à établir l'étiologie des cystes de l'iris. *Compt. rendu*, vol. i., p. 96, No. 3.

MASSE, *Gazette d'opht.*, Paris, 1882, p. 275.

MASSE, *ibid.*, 1883.

MASSE, De la formation par greffe des cystes et des tumeurs perlées de l'iris. Bordeaux, 1884.

GAYET, Formes rares de traumatisme amenant tumeur de l'iris faisant hernie sous la plaie. *Recueil d'opht.*, 1883, p. 101.

SCHWENINGER, Einige Bemerkungen über Wachstum, Regeneration und Neubildung auf Grund histol. u. experiment. Erfahrungen. *Centralbl. f. d. med. Wissensch.*, No. 9.

HOCH, *Correspondenzbl. f. Schweizer Aerzte*, Feb., 1885.

HOCH, Experimentelle Studien über Iriscysten. *Virchow's Arch.*, vol. xcix., p. 446.

EVERSBUSCH, Beiträge zur Genese der Iriscysten, 1880.

EVERSBUSCH, Mittheilungen aus der kgl. Univers.-Augenklinik in München, 1882, vol. i.

EVERSBUSCH, Nagel-Michel's *Jahresbericht*, 1885, p. 353.

HANEMANN, Casuistisch-Kritischer Beitrag zur Lehre von der Entstehung der Vorderkammerabsackungen. Inaug. Dissert., München, 1885.

SCHRÖTER, *Graefe's Archiv*, 1877, p. 417.

STÖLTING, Die Entstehung seröser Iriscysten. *Ibid.*, 1885, vol. xxxi., No. 3.

SCHMIDT-RIMPLER, Zur Entstehung der seröser Iriscysten. *Ibid.*,1885, vol. xxxv., No. 1.

HERRNHEISER, Ueber seröse Iriscysten. *Prager med. Wochenschr.*, Oct., No. 41.

KLEIN, *Lehrbuch der Augenheilkunde.*

QUAITA, Cisti de l'irided. *Annali di Ottalm.*, vol. x.

QUAITA, Proliferazioni degli epitheli corneali sull' iride, etc. *Ibid.*, vol. xiii., p. 145.

GONELLA, Contribuzione allo stadio delli cisti irideæ. *Atti accademia di Med. di Torino*, 1885, vols. v. and vi.

GALLENGO, Osservazione di trapianto dell' epitelio corneale sull' iride. *Giornale della R. Accad. di Medicin. de Torino*, 1885, Feb., 1, 2.

NETTLESHIP, *Royal London Ophth. Hosp. Rep.*, vol. viii., p. 343.

LAWFORD, *ibid.*, vol. iv., p. 208.

SNELL, *ibid.*, vol. x., p. 208.

CRITCHETT, *ibid.*, vol. ix., p. 50.

LANG, *ibid.*, vol. xii.

TREACHER COLLINS, *ibid.*, vol. xiii.

STRAWBRIDGE, *Trans. Amer. Ophth. Soc.*, 1878, p. 385.

KNAPP, *ibid.*, 1880, p. 104.

WILLIAMS, *ibid.*, 1880, p. 104.

NOYES, *ibid.*, 1880.

MONACHO, *Lancet*, May, 1888.

BLAND SUTTON, Hunterian Lectures, Royal College of Surgeons, 1889.

ALT, *Arch. of Ophth. and Otol.*, 1878, vol. vi., p. 317.

RICHARD, *Gazette hebdom.*, 1882, vol. i., p. 1.

DARIER, Dégénérescense cystoide bilatérale de la retine. *Arch. d'opht.* 1890, p. 203.

CHEVALLEREAU and DESPAGNET, *Soc. d'opht. de Paris*, April 5, 1892.

KUHNT, Atrophy des Uvealtractus. *Zehender's klin. Monatsbl.*, 1881.

NICATI, La glande de l'humeur aqueuse. *Arch. d'opht.*, 1890, vol. x., No. 6, and 1891, vol. xi., 1 and 2.

TREACHER COLLINS, The glands of the ciliary body in the human eye. *Trans. Ophth. Soc. Unit. King.*, vol. xi., p. 55.

NEW COLORED-LETTER TESTS FOR SIMULATED MONOCULAR BLINDNESS.

By JAMES L. MINOR, M.D., Memphis, Tenn.

SOME time since I examined a man for simulated monocular blindness. The usual tests were employed, and the deception was easily detected. I was particularly pleased with Snellen's colored-letter test, not only on account of its simplicity, quickness of application, and aptitude in detecting the deception, but because it was so readily demonstrated to others, and so favorably impressed them. To a number of physicians present while the tests were going on, who manifested interest in this particular test, I illustrated and explained its action. The man who had been tested was an interested listener, and it afterwards occurred to me that he would profit by my explanation, if the tests had to be repeated, so I went to work with an idea of constructing some colored-letter test which would resemble Snellen's in appearance, but differ from it in behavior.

As Snellen's test, which consists in viewing transparent red and green letters by transmitted light through red and green glasses respectively, depended upon the fact that stained glass transmitted rays of like color, and absorbed all others,—allowing the red letters only to be seen through the red glass, the green letters only through the green glass,—it was obvious that the substitution of opaque colored letters, and of reflected light, would give the opposite—a negative —picture, provided a suitable background could be obtained for the colored letters.

A light gray—that known in commerce as French gray—proved to be the proper color for the background of pure red and pure green letters, for it assumes the same color as, and becomes indistinguishable from, pure red when viewed through red glass—the same color as pure green, from which it cannot be distinguished when looked at through green glass. Hence red on this background becomes invisible when looked at through red glass, and green likewise invisible when viewed through green glass—and, as red glass is impervious to green rays, and green glass is impervious to red rays, green letters on this background will be clearly seen, and of dark-brown color, when seen through red glass, and red letters will be sharply outlined, and of dark-brown color, when looked at through green glass.

Because of the slight difference in luminosity, and the lack of contrast between red, green, and gray, and the reduction in light, incident upon viewing them through colored glass, it was necessary in constructing the test to have the letters more than double the size of those used for testing vision—for a twenty-foot test they had to correspond to No. L of Snellen.

Block-letters of this size, cut out of pure red and pure green paper, were pasted alternately upon a strip of light-gray cardboard, and a negative of Snellen's colored-letter test was possessed. When, at a distance of twenty feet, it was viewed through red glass, only the green letters could be seen. When viewed through green glass, only the red letters were visible. (Test I.)

As it was clear that the same principles upon which this test depended would apply to one in which translucent colored letters and background, and transmitted light were substituted, I attempted to make a second colored-letter test, and succeeded in getting one with which I was much pleased, for it combined my own test letters, to be used with both reflected and transmitted light, with those of Snellen.

I found that thin layers of French gray, of pure red, and of pure green paints possessed about the same amount of translucency.

Desiring a test which would contain a pair of red and a pair of green letters of my pattern, and a pair of red and a pair of green of Snellen's, a strip of clear glass, twelve inches long by four in width, was given a thin coating of French gray paint. The following letters—HLEYTFZI—were marked out, and the spaces thus outlined were denuded of paint, leaving the letters clear. Then the first and fifth letters were given a coating of red paint, thin enough to give it the same translucency as the gray background. The second and sixth letters were treated similarly with green paint.[1] Behind the third and seventh letters were placed strips of pure red glass, and behind the fourth and eighth letters were placed strips of pure green glass.

By transmitted light this test-plate, as seen by the naked eye, contains eight letters, red and green, alternately. When viewed through red glass, the painted red letters and the transparent green ones are obliterated, while the painted green letters and the transparent red ones remain visible. When looked at through green glass, the painted green letters and the transparent red ones are invisible, while the painted red letters and transparent green ones remain distinct. By reflected light the same results are obtained for the painted letters as just described, while the transparent letters remain visible through either one of the colored glasses. (Test II.)

Snellen's colored-letter test is perfect in itself and under ordinary conditions leaves nothing to be desired, but circumstances occasionally arise when every available safeguard is necessary to overcome the cunning of the malingerer, and to that end the two above-described tests for simulated monocular blindness are offered, with the claim that—

TEST I. furnishes the *negative* test to that of which Snellen's is the *positive*—and may be used independently or in connection with others.

TEST II. combines the *positive* of Snellen's with the *negative* of mine, and adds a set of *confusion* letters (if the transparent letters when viewed by reflected light may be so termed), and hence becomes the most comprehensive colored-letter test that we possess.

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[1] Much care and patience are required to get the proper color and translucency, particularly for the green.

CONGENITAL INTERNAL OCCLUSION OF THE CANALICULI; TREATMENT BY INCISION AND PROBING SUCCESSFUL.

By ALANSON J. ABBE, M.D., Fall River, Mass.

Miss C., aged fifteen, presented herself in October, 1892, with epiphora of the right eye. This was said to have existed from her birth. When about seven years of age, her parents consulted an oculist in regard to her condition, and he declined to attempt any treatment until she was much older. At her present age she is greatly annoyed by her condition on account of the necessity for constantly carrying a handkerchief in her hand, and by the eczema of the cheek, which lasts during the winter months. She is the younger daughter of intelligent parents, and all the members of the family are positive that there was never any inflammation or injury in or about the eye during infancy or childhood. As they said jokingly: "A drop of water got into the eye when she was christened, and it has been there ever since." There is no inflammatory condition present. Left eye normal.

After dilating the inferior punctum, a probe passed easily until it reached the point of union of the canaliculi, where it encountered an elastic resistance, as of a membrane. This was pierced with a rather blunt cambric needle, and then with a glover's needle. This procedure allowed a No. 1 probe to enter the sac with difficulty. A Beer's needle was then used, with which I freely cut the opposing membrane in several directions, after which a No. 4 probe passed readily. A Bowman's incision would have been simpler, and would have saved a good deal of the subsequent treatment, but I desired to avoid even this slight mutilation. No attempt was made to enter the nasal duct at the first sitting. The incised stricture was dilated daily. No effect was produced upon the epiphora, so an attempt was made to probe the duct, when a second obstruction was found at its upper portion, through which a probe could not be forced. Accordingly the cutting needle was again used, when the probe passed readily, and the epiphora was relieved for about fifteen minutes. Probing was kept up about every other day for two months. The time that the instrument was allowed to remain in the duct was increased gradually until it remained there from the late afternoon until the following morning, and the duration of patency increased to a day or two. The frequency of probing was little by little diminished, until in six months from the first operation one probing would prevent an overflow of tears for a week. The second or lower stricture yielded in the course of a couple of months. The greatest trouble was to prevent contraction in the upper one, where a free incision might have been advised. However, this finally came to a nearly quiescent state, so that now, twelve months from the beginning, there has been no overflow for nineteen weeks. An occasional dilatation will undoubtedly be required for years to come, but all discomfort has been removed at no cosmetic or functional sacrifice.

SINGLE-SUTURE OPERATION FOR ADVANCING THE RECTUS.

By A. E. PRINCE, M.D., Springfield, Ill.

(*With two figures in the text.*)

IN the *Ophthalmic Review* of September, 1887, appeared my double-suture operation for advancing the rectus muscle, together with the single-suture method for accomplishing the same purpose.

The publication of the latter method, which is simpler and superior to the former, was but briefly described and not illustrated, and seems to have escaped the majority of readers and reviewers. On this account the liberty is taken of offering it a second time with a more precise description.

In the conception of this operation for advancing the rectus, effort has been made to fulfil the following conditions:

(1) Secure an unyielding anterior fixation point in line with the muscle to be advanced by utilizing the dense episcleral tissue.

In all former operations, the conjunctiva has been made to serve for the anterior attachment of the suture or sutures, and since the resistance of this tissue is feeble, it permits the muscle to retract to a greater or less extent, before its attachment to the sclera has been effected, thus vitiating the accuracy, even though the immediate result may have seemed satisfactory.

(2) Secure the muscle in such a manner that its escape

and retraction may not occur after the tendon has been exsected and the muscle released from the grasp of the advancement forceps.

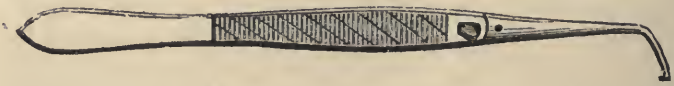
One danger which attends former operations arises from the fact that the security of the sutures depends on the areolar tissue which surrounds and binds the fibres of the muscle together. Since this structure has feeble resistance, a simple suture piercing the muscle is liable to separate its fibres, permitting it to escape. This liability is increased by exsecting the tendon or by introducing multiple sutures which pull in opposite direction, as is the case when one suture is carried into the conjunctiva above and the other below the cornea. This difficulty is surmounted by the formation of a sling enclosing the middle portion of the rectus, together with a corresponding width of capsule and conjunctiva, the cutting tendency of which, being transverse to the fibres of the rectus, is reduced to a minimum.

(3) Secure the suture with such a knot as will permit of its being loosened for the purpose of increasing or diminishing the tension, or the introduction of another suture farther back; the former may be needed to effect precision in the correction of diplopia and heterophoria, and the latter in extreme degrees of deviation.

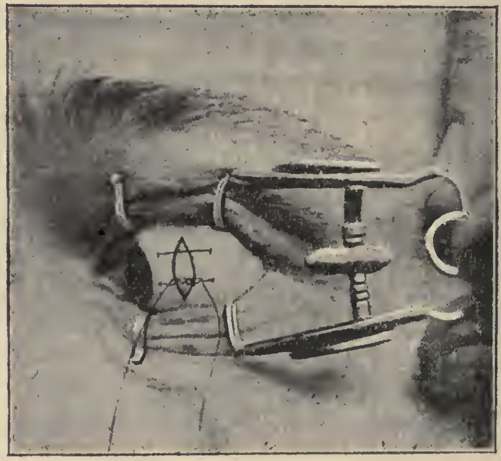
While the first two considerations have met with general approval, the application of an adjustable knot has been sanctioned by some and as honestly condemned by others.

In answer to such criticism it should be said that a verdict relative to the merit of this feature should not be based on theory, but should be rendered by the court of observation and experience. In my own practice it is usually employed, and is never omitted when for any reason the operation is performed under general anæsthesia. The knot is secured with a bow to be left until voluntary muscular action has returned. If no modification is deemed necessary the bow is divided, the superfluous portion of the suture removed, and the remaining ends tied again without disturbing the knot. The security felt of being able to control the effect at will, more than compensates for the extra trouble, even though a modification were seldom found necessary.

In the following description the liberty is taken of indicating my preference in the use of materials.



Not finding a satisfactory advancement forceps in the market, Tiemann has filled this want for me. The particular feature of the operation is the introduction of a suture into the episcleral tissue, which is facilitated by a very slender, sharp, curved needle, with a comparatively large eye. Each will exercise his choice relative to a fixation forceps, but preference is given to that of Critchett, because, having two fine guarded points, the sclera is fixed directly and not through the medium of the conjunctiva. The suture preferred is fine, strong, black, iron-dyed silk, such as is furnished by Tiemann and designated No. 3.



DESCRIPTION.

A conjunctival incision is made over and parallel to the attachment of the tendon of the muscle to be advanced.

The tendon is secured by an advancement forceps, separated from the sclera and advanced, allowing the conjunctiva to retract.

Two slender eye needles (Tiemann No. 25), on either end of a No. 3, iron-dyed, silk suture, are passed from within, outward, perforating the capsule, muscle, and conjunctiva at a variable point depending upon the amount of displacement to be effected, thus securing the middle portion of the muscle in a sling, from which it can neither slip nor escape.

With the exception of cases requiring a small amount of advancement of the muscle, or those in which the suture is used as a control to prevent an over-correction following a tenotomy, the portion of the tendon in the grasp of the forceps is exsected about two *mm* anterior to the sling.

The sclera being now fixed, preferably with Critchett's short fixation forceps (Weiss), an unyielding anchorage in the form of a fibrous pulley is secured in line with the rectus by introducing either needle into the dense episcleral tissue two *mm* from the sclero-corneal junction.

Both ends of the suture are now brought together, forming the first portion of a surgical knot, and tightened to effect a slight over-correction. This may now be secured or provisionally held by the application of a bow until the muscular tonicity shall have returned, thus enabling the effect to be modified at any time before adhesion has taken place. The suture is permitted to remain four days, unless it is desired to diminish the effect, which may safely be done after forty-eight hours, by removing the suture and cautiously opening the wound.

ON THE VISUAL ACUTENESS OF THE PERIPHERY OF THE RETINA, AND ON A NEW METHOD OF DETERMINING IT.

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(*With two figures in the text.*)

A GREAT number of investigations have been made on the acuteness of indirect vision, yet no one of the methods employed is altogether reliable, since each makes too great demands upon the powers of observation of the individual examined. Nor have we any law generally applicable to the acuteness of vision of the periphery of the retina. The discovery of such a law seems desirable, when we take into account the importance which the examination of this function of the retina has in many diseases of the eye.

Excepting some superficial earlier investigations by Volkmann, Weber, and Hück, we owe our first definite knowledge of this subject to Aubert and Förster. They set up in a fairly dark room a sheet of paper covered with various letters and figures, which was momentarily illuminated by an electric spark, and from the size and number of the test-characters recognized, they computed the extent of the field of vision for a given visual acuteness. Another series of experiments was made by sliding a card with two black spots from the periphery toward the point of fixation, and finding at what point the spots were recognized as two. The results showed that the acuteness of vision diminishes from the point of fixation to the periphery, and that the portion of the retina in which forms of a given size are distinctly recognized, is not a circle but approximately an ellipse with its major axis horizontal.

Later a great number of investigators made similar experiments, some using a perimeter, some a plane surface, while quadrants of paper, double and multiple points, letters, and conventional characters were employed as test-objects. All agreed that the visual acuteness diminished from the macula to the periphery, but the statements as to the nature and degree of this diminution presented many discrepancies, due to the great difficulty of determining exactly where a peripheric object is clearly recognized and where it is not.

A definite law of decrease has been given by but two observers, Hirschberg for Snellen's test-letters, and Burckhardt for his international tests. The two differ considerably. Hirschberg states that with a Förster perimeter, at a point 4–5° outward from the point of fixation, Snellen IV is recognized; at 10°, Sn. X; at 20°, Sn. XX, beyond which there is a more rapid diminution, and at 30° only Sn. L–LXX is recognized; and at 40°, Sn. C–CC.

According to Burckhardt, contrary to previous observations, the decrease is similar in all meridians. For a distance of $\frac{1}{4}$–$\frac{1}{3}$° from the point of fixation, vision is equal to central vision, or 1; $\frac{1}{2}$° from the point of fixation it is $\frac{1}{2}$–$\frac{4}{5}$. Nearer the periphery the acuteness of vision is expressed by a fraction the numerator of which is 1 and the denominator 2–4$\frac{1}{2}$ times the degree of distance from the centre. The formula holds good up to 40–50°, beyond which point the decrease is more rapid.

Graefe and Wertheim used as test objects multiple points, and found the degree of distance from the point of fixation at which the points were recognized as discrete.

The cause of the diminished acuteness of vision in the periphery of the retina was explained by Förster and Aubert as being due to the percipient elements of the retina, and not to an indistinct image-formation, or to a diminished intensity of illumination in the periphery.

In experimenting to determine the light-sense of the periphery of the retina Aubert found that a bright object seen indirectly did not appear darker than the same object seen directly, and from this he concluded that the light-sense does not show marked differences in different portions of the retina. Other investigators found that the diminution in sensitiveness for differences of luminous intensity was much less in the periphery of the retina than the diminution in acuteness of vision. Schadow made examinations of the irritation-threshold, finding the minimum intensity of light which would produce a luminous impression in the macula and in the periphery of the retina. He found that the sensitiveness to luminous impressions at 30° inward from the fovea was $\frac{4}{3}$, and at 60° inward $\frac{1}{2}$, the central sensitiveness being taken as 1; the sensitiveness at 30° from the fovea being greater than at the fovea itself.

The periphery of the retina possesses a great sensibility for the perception of motion. When a group of points is viewed in such a portion of the field that they are not recognized as distinct points, a very clear impression is got when a single point is suddenly added or removed.

As was previously stated, the results of different observers vary greatly, and we have no general law for the acuteness of vision in the periphery. In the following pages I shall endeavor to formulate such a law on the ground of a method of investigation differing from those previously employed.

I was led to the discovery of the method by the following observation. As Prof. Förster was one day passing through an open space where boys were flying kites, he was struck by the fact that when he simply glanced at the sky he saw none of the kites, but when he looked attentively he discovered five kites which appeared as small gray points. It was, however, impossible to recognize all five points simultaneously although they were near together. The portion of the visual field in which the points were recognized must have been very small.

This observation stands in apparent contradiction with one of daily experience, viz., that an eye with weak sight will recognize the stars which subtend a smaller visual angle than the kites, not only in a small central portion of the field but even in its most peripheric parts. This apparent contradiction and the fact that the examination of the form-sense of the periphery of the retina is impracticable, led me to believe that the examination of the acuteness of indirect vision by means of small dark objects on a light ground might give us a definite law. A few examinations showed the truth of this supposition.

The question now presents itself, what do we understand by acuteness of vision? As the term is commonly used, the determination of the acuteness of vision consists in finding the smallest angle under which the form of a given object can be recognized. For this purpose we employ characters of such nature that particular points must be distinguished in order to recognize them. The recognition of a single point depends entirely upon the degree of illumination, for with sufficient illumination the smallest object can be seen. This conception of acuteness of vision is equivalent to distinguishing power or form-sense. Acuteness of vision may also be conceived as being determined by finding the smallest point which the eye is capable of recognizing. Aubert has called this point the "physiological point." In this paper physiological point will be used as expressing not the smallest point that can be perceived, but the portion of the retina covered by the image of such a point. I would term this conception of acuteness of vision "acuteness of vision for a point" (Punkt-Sehschärfe). The shortest distance within which two points can be recognized as discrete has been called by Weber the "diameter of a perception-circle."

We shall determine, then, first the size of a physiological point, or the visual acuteness for a point, and then the extent of a perception-circle or the distinguishing power, for the different portions of the retina. The physiological point is larger in the periphery of the retina, but the size of the perception-circle increases toward the periphery more rapidly than that of the physiological point, although these two functions of the retina are closely correlated and are not more or less independent like the light-sense and the color-sense.

In testing the size of the physiological point a bright object should not be employed, since the image of a luminous point on the retina is not a sharp point, but a larger dispersion-circle, the size of the retinal image standing in no measurable relation to the visual angle under which the object is seen.

An object which contrasts strongly with its surroundings in luminosity may be recognized even when its image on the retina is much smaller than a percipient element of the retina.

Aubert in his experiments used black or white test-objects on a gray ground. With white objects variations in the tone of the background led to much greater differences in the visual angle than when black objects were employed.

With black objects the visual angle remained about one half minute within certain limits of tone of the background, and with marked differences of illumination; from which we may conclude that the physiological point in the centre of the retina corresponds to a visual angle of one half minute.

ORIGINAL EXPERIMENTS.

My first experiments were with black and gray quadrants 1 and 2 *mm* square, on a white ground, and with white and gray quadrants on a black ground. Daylight was used and the objects were brought nearer from a great distance until they were perceived by my left emmetropic eye.

Table I. gives the results, gray I. being the lightest, gray IV. the darkest.

TABLE I.

Object	Visual Angle	Object Lighter or Darker than Ground.
Chinese black on white..........	28.9″	58 times darker
Gray IV. on white...............	30.7″	16 " "
Gray IV. on gray I..............	33.8″	13 " "
Gray II. on white...............	40.5″	2.31 " "
Gray I. on white.............	43.2″	1.25 " "
White on dull black.	18.8″	38 times brighter
Gray I. on ivory black...........	20.3″	18.6 " "
Gray II. on ivory black.	26.9″	9.89 " "

The table shows that a dark gray and a black object on a white ground are seen under an approximately equal angle. The angle is but slightly larger for a dark-gray object on a dark-gray ground. A very light quadrant on a light ground, however, requires a much larger visual angle. To find the size of the perception-circle, the distance was measured at which two round black spots, their diameter apart, were recognized on a white ground.

To find the physiological point of the periphery of the retina a white card with a black point in the centre was moved along the arc of a Förster perimeter. The black points used had a diameter of ¼, ½, 1, 2, and 4 *mm.* The central acuteness of vision and the refraction were first determined with Snelling's test-types, and the acuteness of vision for a point by Guillery's method. If we call the acuteness of vision for a point = 1 when a black point on a white ground is just recognized under an angle of 50″ (Guillery), it would = ½ when the point was seen only under an angle of 100″, ⅓ when under an angle of 150″. At a distance of 310 *mm*, the radius of the perimeter, a point of 0.0761 *mm* diameter is seen under a visual angle of 50″. If for another portion of the retina a point of ¼ *mm* is just distinguished at 310 *mm* distance, the acuteness of vision for a point is slightly more than ⅓.

The results of the experiments were as follows: The physiological point increases from the macula toward the periphery, rapidly at first, more slowly later. This increase is not the same in all directions, but the limits of perception for a given point form a horizontal oval parallel to the limits of the visual field. Fig. 1. shows the limits in an emmetropic eye.

According to Helmholtz a point of light, the retinal image of which is much smaller than a retinal percipient element, may be perceived provided that the amount of light which enters the eye is great enough to really affect a retinal element. And in the same way a dark object on a light ground may be recognized although its retinal image is smaller than a percipient element, provided that the light which falls on the retinal element is perceptibly diminished by the dark image. If, for example, with a given illumination, an eye can distinguish a difference in intensity of light amount to $\frac{1}{50}$, then a dark image the extent of which is $\frac{1}{50}$ of that of a retinal element can still be perceived. In my investigations, however, the images of the black points used were not smaller than the percipient elements of the retina; the retinal image received under a visual angle of 29″ being 0.0021 *mm* in diameter, and the diameter of a cone being 0.0020–0.0025 *mm* according to Schultz, and 0.0015–0.0020 *mm* according to Müller.

The luminosity of the white, gray, and black papers was determined by Aubert's method. In a room lighted by a petroleum lamp, the distance from the light is found at which each of two discs appears of the same luminosity. White at 795 *cm* and black at 104 *cm* from the light having an equal intensity, the white disc is $(\frac{795}{104})^2 = 58$ times lighter than the black. Newton's disc was also used with black and white sectors.

After determining in this manner the luminosity of various bits of paper, perimetric examinations were made to find what variations existed in respect to the perception of a dark object on a light ground, with different intensities of illumination. The results showed that for the entire retina a white object on a dark ground is recognized under a smaller visual angle than a black object on a light ground. Table II. was obtained by testing my left eye. The table shows that a dark object on a light ground is seen the more peripherically the more the object contrasts with the ground. The difference in perception is slight, however, and for practical purposes an ink spot, of given size, on white paper may be considered a constant.

A dark point on a light ground, in order to be recognized, must subtend a greater angle the more peripheric it lies. From this it follows that the physiological point becomes larger as we pass from the centre to the periphery of the retina. Experiments have shown that this cannot be explained by the difference in refraction between the central and the peripheric portions of the retina, nor by the less intensity of peripheric retinal images. The explanation

TABLE II.

	Test-object.	Object Darker than Ground.	Field Meridian of Sight.												Average
			up			out			down			in			
			0°	20°	60°	90°	120°	160°	180°	200°	240°	270°	300°	340°	
1.	Gray I. 1 mm^2 on white	1.25 times	24	25	30	38	35	26	20	23	28	31	30	28	28.2
2.	Gray II. 1 mm^2 on white	2.31 "	25	27	33	40	35	29	25	24	29	31	31	30	30
3.	Gray IV. 1 mm^2 on gray I.	13 "	28	33	36	40	35	29.5	29.5	26	29	33.5	34	34	32.3
4.	Gray IV. 1 mm^2 on white	16 "	28.5	33.5	38	42	35	31.5	31	28.5	32	36	34.5	34	33.7
5.	Black 1 mm^2 on white	58 "	29	33.5	38	43	37	32.5	31	28.5	32	37	35	35	34.3
6.	Gray I. 2 mm^2 on white	1.25 times	31.5	36	46	49	42	38	33	34	35	43	42	36.5	38.8
7.	Gray II. 2 mm^2 on white	2.31 "	35	40.5	50	55	48.5	46.5	35	40	37.5	44	44.5	42	43.2
8.	Gray IV. 2 mm^2 on white	16 "	36	42	51.5	57	50	49.5	38	42	38	47	46	42.5	45
9.	Black 2 mm^2 on white	58 "	37	43	53.5	58	51	50	39.5	43	39	48	47	44.5	46.1
		Object lighter than ground.													
10.	Gray I. 1 mm^2 on black	18.6 times	39	39	54	63	60	50.5	50.5	47.5	40	48	47	42	48.4
11.	Gray II. 1 mm^2 on black	9.83 "	36	35	48	59	52	46	45	44	40	43	45	40.5	44.5
12.	White 1 mm^2 on black	38 "	40	39	58	68	60	58.5	50	50	44	50	51	42	50.9
13.	White 2 mm^2 on black	38 "	41	46	65.5	80	64	59.5	50.5	54	45	51	51	44.5	54.3
14.	White 5 mm^2 on black	38 "	58	62.5	79	88	90	77.5	72	62	56	60	60	59	68.7

must be looked for in the retina itself. The fewer number of cones in the periphery of the retina, allowing that the cones alone are sensitive to light, will not explain it, since the difference in the size of the physiological point is greater than would correspond to the decrease in the number of the cones. We must, therefore, conclude that the sensibility of the elements of the periphery of the retina is less than the sensibility of those in the centre.

The size of the physiological point in the periphery of the retina does not give us the form-sense or distinguishing power or acuteness of vision in the ordinary acceptation of the term; for the latter depends upon the power of recognizing two points as distinct. Experiments to determine the acuteness of vision in the periphery are difficult, and I have determined only the horizontal meridian for my left eye. (Table III.)

TABLE III.

Distance from fixation point outward.	Diameter of physiological point.	Two black points are recognized as distinct with a diameter and distance apart of.	Distance from fixation point inward.	Diameter of physiological point.	Two black po'ts are recognized as distinct with a diameter and distance apart of.
0°	0.06 *mm*	0.13 *mm*	0°	0.06 *mm*	0.13 *mm*
19°	0.38 "	3.00 "	19°	0.45 "	3.00 "
33°	0.66 "	5.00 "	32°	0.92 "	5.00 "
40°	0.88 "	10.00 "	44°	1.74 "	10.00 "

Since the distance which must exist between two objects in order that they may be seen as distinct corresponds nearly to the size of a perception-circle of the retina, the results given in Table III. may be expressed as follows: If we consider a physiological point and a perception-circle as projected on the arc of the perimeter, the physiological point for the centre of the retina would be 0.06 *mm*, and the perception-circle 0.13, the latter twice the size of the former. 33° outward the two stand in the relation of 0.66 : 5.00 or 1 : 7½; 32° inward the relation is as 1 : 5⅓. Thus the size of the physiological point and that of the perception-circle stand in no constant relation.

The question now suggests itself, why is the perception-circle in the periphery of the retina much larger than the physiological point, while in the centre of the retina there is so little difference between them? The following hypothesis for the nerves of touch gives us the best answer: Let us conceive (Helmholtz) a surface with sensitive elements, the nerves of which break up into a fine anastomosing network of fibres which are in connection on the one side with the numerous sensitive elements of the surface, and on the other with the much fewer number of fibres leading to the brain. Let us suppose further that each irritation of a sensitive element be communicated through the network to the nerve-fibres arising from the network, but more weakly to those fibres farther removed. In these conditions every point of the surface would be sensitive, and the irritation of various points between the origins of three nerve-fibres would make different impressions, the irritation being distributed in different measure in the three nerve-fibres according as the irritated point were nearer the one or the other. If now fine gradations in the intensity of the irritation in such neighboring fibres could be recognized, very fine distinctions as to the position and motion of a single stimulated point would be possible. But two impressions among the nerve-fibres conducting them would always appear as a single middle one. Such an arrangement would permit a very limited distinction of two points irritated simultaneously, but still a fine appreciation of the movement of an irritated spot.

It may seem strange that so little attention has been paid to the form-sense of the periphery of the retina, but I have convinced myself that investigations on the form-sense in indirect vision, even with so simple a test-object as two points, are extremely difficult and of little value.

The examination of peripheral vision, as regards perception of a small black point, has shown that the limits for the recognition of the point have the form of a horizontal oval, nearly parallel to the limits of the visual field. In order to be clear in the meaning of limits of perception, Hirschberg's term isopter may be used. An isopter is the line joining those portions of the retina in which the physiological point

TABLE IV.

Test-object.	Observed eye. *Cf.* Table III.	Up.			Out.			Down.			In.		
		0°	20°	60°	90°	120°	160°	180°	200°	240°	270°	300°	340°
White quadrant of 5 *mm.*	I	58	62.5	79	88	90	77.5	72	62	56	60	60	59
	II	54	64	84	93	93	86	74	70	67	59	60	59
	III	60	64	84	94	94	74	63	62	61	57	58	58
	IV	53	64	82	93	93	72	74	63	56	59	54	54
	V	48.5	52.5	78	88	91	69.5	69	73.5	63	69	63	53
Average.	—	55	61.5	81.5	91	92	76	70.5	66	60.5	61	59	56.5
Black point on white ground, 4 *mm* diameter.	I	40	47	60	71	67.5	61	52	50	45	52	51	48
	II	52	55	70	87	82	74	64	58	61	62	60	53
	III	49	58	75	83	83	72	52	58	51	55	54	52
	IV	46	56.5	73	79	77.5	69	56	54	53	53.5	50	51
	V	45.5	51.5	67.5	76.5	83	64	59	59	49	56	55.5	48
Average.	—	46.5	53.5	69	79	78.5	68	56 5	56	52	55.5	54	50.5
Black point, 2 *mm* diameter.	I	38	40.5	50	58	53	49	40	42	38	47.5	46	42.2
	II	46.5	48	59	67.5	64	52	53	50	49	59	57	53
	III	37	45	54.5	68	71.5	50	49	45	45.5	50	50	44
	IV	43	48	63	69	71	56.5	52	40.5	49	49	47	40
	V	35	41	50	56.5	50	47	42	45	41	44	44	39.5
Average.	—	40	44.5	55	64	62	51	47	44.5	44.5	50	49	44
Black point, 1 *mm* diameter.	I	27	31	36	44	36	32.5	30.5	29.5	31	34	32	31.5
	II	35	31	38	45.5	41.5	39.5	38.5	35	37	38	38	33.5
	III	30	31	38	46	37	33	36	32	34	31	34	31
	IV	30	35	42	47	41	37.5	30	33	37	33	33	29
	V	25	28.5	37	38	35	32	31	33	30	32	33	29
Average.	—	29.5	31	38	44	38	35	33	32 5	34	33.5	34	31
Black point, ½ *mm* diameter.	I	18.5	18	21	28	28	20.5	20	18.5	21	22	21.5	20
	II	21	20	22	30	30	24	18	20	23	29.5	23	19
	III	21	22	24	27	23	18.5	20	23	23	21	21.5	18.5
	IV	15	21.5	26	38	23	21	18	21	21	23.5	19	18
	V	15	16	20.5	22.5	20	22	18	19	20.5	22.5	19.5	17
Average.	—	18	19.5	22.5	27	25	21	19	20.5	21.5	23.5	21	18.5
Black point, ¼ *mm* diameter.	I	7	7.5	8.5	10	8	9.5	10	8	9	11	11.5	8.5
	II	8	9	9	8	11	8	9	8.5	10	11	10	9
	III	7	7	9	13	8.5	7	10	10	11	16	9	9
	IV	11	10.5	9	12	12	13	10	11.5	12	14	9	10
	V	4.5	6.5	6	8	9	10	6	8	7	6	5	8
Average.	—	7.5	8.1	8.3	10.2	9.7	9.5	9	9.2	9.8	11.6	9	9

has a common size. For the limits of the form-sense we may use the word isomorphopter, meaning the line joining all portions of the retina in which the perception-circle has a common size. Fig. 1 represents a visual field plotted after Table IV.

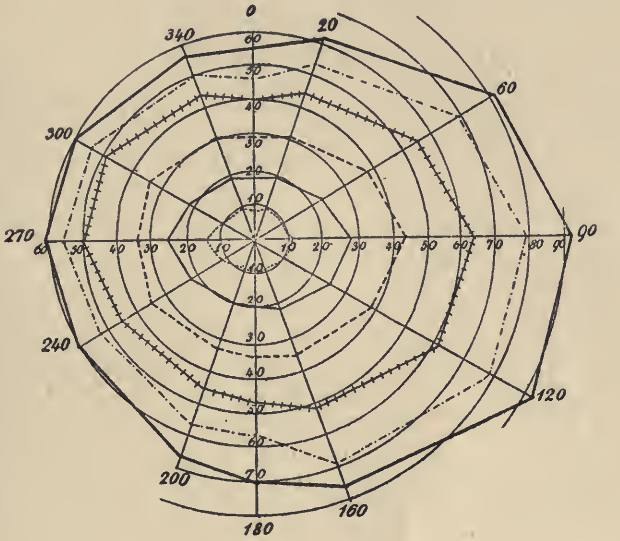

FIG. 1.

━━━━━━━━	white quadrant, 5 *mm.*
—·—·—·—·—·—	black point on white ground, diameter, 4 *mm.*
—|—|—|—|—	" " " " " " 2 *mm.*
— — — — — —	" " " " " " 1 *mm.*
————————	" " " " " " ½ *mm.*
········	" " " " " " ¼ *mm.*

The physiological point increases rapidly in size as we go from the centre, and at 10° it is 3–6 times as large as in the centre. Further toward the periphery the physiological point increases more slowly but regularly. Excepting very near the centre and in the extreme periphery the increase in the size of the physiological point follows a fixed law. If a meridian of the visual field, reckoned from the fixation point to the limit of perception for a 5 *mm* white quadrant, be divided into six equal parts, the diameter of the physiological point increases twice for each sixth part as we go toward the periphery. This law may be expressed by the formula $y = \frac{1}{8} . 2^{\frac{x.c}{a}}$, in which y is the diameter of the physiological point in *mm* projected on the arc of a perimeter of 31 *cm* radius, a the distance in degrees from the fixation point to the peripheral limit of the field for the given meridian, and x the parallel circle for which the value y is required ; c represents a number which is on an average $= 6$, although for the outer circle it is somewhat less, and for the inner circles somewhat more. If we wish to compute the diameter of the black point, which can just be perceived at 18° in the upper vertical meridian, a is put as 55, since the peripheric limit upward is 55°, x is 18, and c is 6. Then $y = \frac{1}{8} . 2^{\frac{18.6}{55}} = \frac{1}{2}$ *mm.*

The visual angle α under which a black point on a white ground must appear in order to be recognized in a given portion of the retina, is obtained by the formula: $\angle \alpha = (1' \; 22'') \; 2^{\frac{x.c}{a}}$, the values of x, a, and c being as before.

Experiments made with different intensities of illumination showed that variations in objective intensity within wide limits have but little influence upon the position of the isopters.

In order to determine the relation of the isopters to variations of central acuteness of vision, the visual angle was found in five eyes and also the isopters for black points of various size. The isopter for the point $\frac{1}{4}$ *mm* was more peripheral in eyes with greater acuteness of central vision. The position of all the isopters except the one nearest the fixation point remains unchanged with variations of acuteness of central vision. In myopes the isopters are much smaller when the myopia is corrected with glasses than when not. This cannot be explained as being due to the prismatic action of the glasses, as this would increase the size of the isopters, but rather to the decrease in the size of the retinal image due to the displacement of the nodal point.

In pathological conditions of the eye the examination of the periphery of the retina by means of black points often reveals alterations in the field of vision which are not shown by other methods or even by tests with colored papers. In cases of color scotoma, for example, it is often difficult to determine the limits of the scotoma, for there exists about the absolute scotoma a zone of relative scotoma, and the patient is not always certain as to the point where the color is first seen. With black points the difficulty is done away with and the exact limits of the scotoma may be made out. If there be a zone of diminished perception, this is readily made out by using points of different sizes, the scotoma being larger for small points. A black point of 1 *mm* is an exceedingly fine test-object for determining a central scotoma.

In the case of a young girl with retrobulbar neuritis there was a central defect for a red quadrant of 5 *mm*, extending 4–5° in each direction from the point of fixation. In the centre was a small absolute defect. The examination with a black point 1 *mm* in diameter revealed a scotoma extending 30° in every direction, the point being recognized only in a narrow circular peripheric zone. In the beginning this zone was interrupted upward, but later the zone became complete and gradually grew wider as the case improved, and the central scotoma became smaller. Thus the visual field obtained by the examination with black points shows us the form that the color fields will take as the disease progresses, and the color-field defect does not represent the entire portion of the field that is affected.

One thing more should be considered. The size of the physiological point stands in no constant relation to the size of the perception-circle. It might therefore be supposed that with a central scotoma the physiological point would be smaller for a peripheral portion of the retina than for the centre, and the perception-circle larger in the periphery than at the macula. In other words, the acuteness of vision for a point might be better in the periphery than in the centre, the distinguishing power however being best preserved in the centre.

An eye with axial retrobulbar neuritis examined in this respect gave the relations shown in Fig. 2.

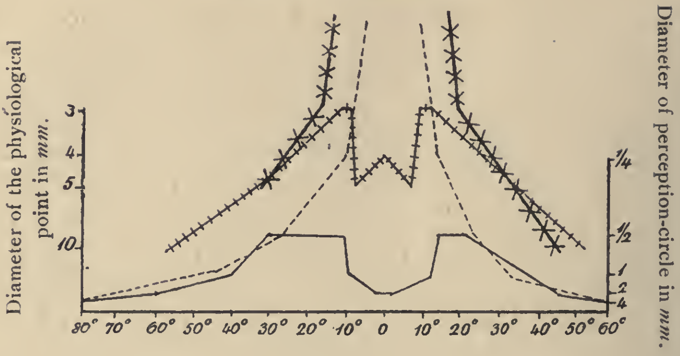

FIG. 2.

out — in

— × — × — × — ×	form-sense	normal
— — — — — —	acuteness of vision for a point.	normal
— | — | — | — |	form-sense	in central scotoma
————————	acuteness of vision for a point.	in central scotoma

The four curves represent the values of the visual acuteness for a point and of the form-sense. The acuteness of vision for a point is put inversely proportional to the diameter of the physiological point, the form-sense inversely proportional to the diameter of the perception-circle. The latter value was found by the test of the double points. The abscissa in Fig. 2 corresponds to the horizontal meridian of the visual field, the fixation-point being at 0°, the portion to the right being the inner, and to the left the outer half of the visual field marked in degress. On this abscissa are erected as ordinates the values of the acuteness of vision for a point and of the form-sense. The scale to the right gives the size of the physiological point for the corresponding portion of the curve, while the scale to the left gives the diameter of the perception-circle measured by the distance between two points which are just recognized as discrete. The curve for the form-sense shows peripherically outward and inward first a gradual elevation up to the 10th parallel circle, then falls precipitously toward the fixation point, to rise again in the centre but not to its former height. The form-sense for the horizontal meridian then in this case is best 10° outward and inward from the point of fixation, and somewhat less in the centre. The acuteness of vision for a point reaches its greatest height at the point where the form-sense is peripherically best preserved, but in the centre it is proportionately to the form-sense much reduced. There is then a point 10° outward and one 10° inward from the macula, with which the patient sees relatively best, and which he therefore uses for fixation. He also fixes at times with the yellow spot since the form-sense here is but slightly reduced below that of the two peripheric points. This relation explains the fact that in observing an object his fixation often changes, shifting from one of these points to another.

In a tabic patient aged thirty-two there was atrophy of the left optic nerve, and he only distinguished light and dark, while the right eye still had normal vision. The ophthalmoscope showed atrophy of both nerves, more pronounced in the left. In the right the fields, taken with white, blue, red, and green quadrants 5 *mm* square, showed normal limits. The examination with black points on a white ground, however, showed a marked contraction of the field. A black point 4 *mm* in diameter was recognized only within the 20th parallel circle on a Förster perimeter, a point of 2 *mm* only within the 12th, and a point of 1 *mm* only within the 5th to 8th circle. In this case then there was a disturbance of peripheric vision which was not made out by the ordinary examination with colored quadrants.

The marked feature of the visual field in retinitis pigmentosa is that, notwithstanding the great concentric contraction, all colors are recognized nearly to the limits of the field for white. This is confirmed by the examination for the position of the isopters. A patient with the disease well marked had a central acuteness of vision of $\frac{1}{2}$; the limits of the field for a white quadrant of 5 *mm* were 10° from the fixation point; a black point $\frac{1}{2}$ *mm* in diameter was recognized in the same extent of the field, and the isopter for a point $\frac{1}{4}$ *mm* in diameter was 4–5° from the centre.

The same patient had a marked hemeralopia, the test-object in a Förster photometer being recognized only with an opening of 144 *qmm*, while the normal eye should see it with 2 *qmm*. The central acuteness of vision for test-letters was for the right eye $\frac{5}{9}$, for the left $\frac{4}{9}$. A black point 0.2 *mm* in diameter was recognized centrally with the right eye at 44 *cm* distance, with the left at 36 *cm*. With $V = 1$ the point should be seen, according to Guillery, at 82 *cm*. The visual acuteness for a point in the right was $\frac{44}{82}$, in the left $\frac{36}{82}$, which corresponds with the results for the form-sense $\frac{5}{9}$ and $\frac{4}{9}$ respectively. With the disturbance of light-sense the acuteness of vision for a point was not more reduced than the form-sense.

For habitual amblyopia or amblyopia ex anopsia we have no definite criterion, but we diagnosticate it by exclusion. A colleague whose acuteness of vision was $1\frac{1}{2}$ in one emmetropic eye, had $V = \frac{1}{2}$ in the other eye with two dioptries of hyperopia. The second eye had clear media and showed nothing pathological except the poor vision. This eye had seen poorly from childhood, and the diagnosis habitual amblyopia seemed proper. The visual field is the same in each eye as regards its limits and the position of the isopters for points from $\frac{1}{2}$ to 4 *mm*. The isopter nearest the point of fixation is 1–2° more peripheric for a point $\frac{1}{4}$ in diameter, in the eye with normal vision. In this case at least the habitual amblyopia was due to an affection or rather a defective development of the centre of the retina, peripheral vision being normal.

These examples will suffice to show that the examination of the acuteness of vision for a point in the periphery of the retina may in pathological cases give us information not otherwise to be obtained, and that it therefore deserves to be considered a diagnostic test.

In conclusion I wish to express my thanks to Professor Förster for having suggested this study and for having followed with interest my investigations.

SYSTEMATIC REPORT ON THE PROGRESS OF OPHTHALMOLOGY DURING THE FIRST AND SECOND QUARTERS OF THE YEAR 1893;

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Translated by Dr. Ward A. Holden.

Sections I.–V. Reviewed by Dr. St. BERNHEIMER.

I.—GENERAL OPHTHALMOLOGICAL LITERATURE.

TEXT-BOOKS, MONOGRAPHS, AND TREATISES ON GENERAL, BIBLIOGRAPHICAL, AND HISTORICAL SUBJECTS.

STATISTICAL REPORTS.

557. Orlowsky. A brief report of the eye patients in his private institution in the years 1889–91. *Wjestnik Ophth.*

558. Gunning. Society for Maintaining an Institution for Eye Patients in Amsterdam. Twentieth Annual Report, 1892.

559. Van Moll. Report of the Institution for Eye Patients in Rotterdam, 1892.

560. Bouvin. Third Report of the Institution for Eye Patients in Gravenhagen, 1892.

561. Westhoff. Report for the year 1892 of the Amsterdam Charitable Policlinic.

562. NEW YORK OPHTH. AND AURAL INSTITUTE. Twenty-third Annual Report, 1892.

563. MASSACHUSETTS CHARITABLE EYE AND EAR INFIRMARY. Sixty-seventh Annual Report, 1892.

564. GAYET. Elements of ophthalmology for the use of practising physicians. Clinical lectures before the medical faculty of Lyons. Masson, 1893.

565. H. SNELLEN, Jr. The Third Meeting of the Ophthalmological Society of the Netherlands, 1893.

566. KÖNIG. Early contributions to the physiology of the organs of sense, republished and translated. The illumination of the eye and the invention of the ophthalmoscope treated in papers by Brücke. Cuming, Helmholtz, and Ruete. Hamburg and Leipsic. L. Voss.

567. CZERMAK. Operations on the eye. Part I., Vienna. C. Gerold's Son.

568. MAGNUS. Ophthalmic charts. Part III. A comprehensive representation of ocular paralysis by Landolt. Breslau, 1893. Kern.

569. EVERSBUSCH. The new university eye clinic in Erlangen. Wiesbaden, 1893. J. F. Bergmann.

570. DIMMER. The ophthalmoscope and ophthalmoscopic diagnosis. Second edition. Leipsic and Vienna, 1893. Franz Deutike.

571. VOSSIUS. A guide to the use of the ophthalmoscope, for students and practitioners. Third edition. Berlin, 1893. Hirschwald.

572. REPORT OF PROFESSOR MAGNUS' EYE CLINIC FOR 1892.

573. SCHRIEBER'S EYE INSTITUTE IN MAGDEBURG. Tenth Annual Report. Magdeburg, 1893.

574. DEUTSCHMANN. Contributions to ophthalmology. Parts VI.–X. Hamburg and Leipsic. Vass, 1893.

575. PRESBYTERIAN EYE, EAR, AND THROAT CHARITY HOSPITAL OF BALTIMORE. Fifteenth Annual Report, 1892.

576. HOLT, E. E. Maine Eye and Ear Infirmary. Seventh Annual Report. Portland, Maine, 1892.

577. KIPP, C. J. Newark Charitable Eye and Ear Infirmary. Thirteenth Annual Report, 1892.

ORLOWSKY'S (557) eye patients were 1665 of a total of 6499, or

24.87 per cent. of all his patients. The total number of operations was 602, 289 being expressions of trachoma granulations, 198 cataract extractions, and 42 iridectomies. HIRSCHMANN.

In the Amsterdam clinic (558) in 1892, 10,229 patients were treated, 687 being in-patients, and 41 being operated for cataract.

In Rotterdam (559) 2064 patients were treated, 209 being taken into the hospital, and 49 being operated for cataract.

BOUVIN (560) reports 3375 eye patients, 160 in-patients, and 25 cataract extractions.

In the Amsterdam policlinic (561) 1752 patients were treated, 31 in-patients, and 14 cataract extractions. WESTHOFF.

At the New York Ophth. and Aural Institute (562) 7355 new eye patients were seen; 781 operations were made (minor operations not included), 173 being cataract extractions, with a good result in 151, moderate in 17, and a poor result in 5.

BURNETT.

The total number of new patients seen at the Massachusetts Eye and Ear Infirmary (563) in 1892 was 12,573. The carefully prepared statistical report shows 94 combined extractions; 85 of these were uncomplicated, and the vision in all but 8 was over 0.1. Three simple extractions were done, but none with very good result. In 30 cases a small peripheric portion of the iris was excised, all of these cases but two obtaining vision better than 0.1. BURNETT.

The purpose of GAYET (564) was not to write a new text-book of ophthalmology, but, in the form of clinical lectures, to present to the general practitioner such facts as are indispensable to him. The present volume treats only of the external diseases of the eye. We cannot better characterize the general nature of the work than by assuring the reader that each page reveals the personality of the author. SULZER.

SNELLEN, Jr., (565) first reports a plastic operation for excessive ectropium of the upper lid. An unpedicled flap sloughed. Thiersch's method gave a better result. Small defects were covered later by pedicled flaps, and an eyebrow formed from the scalp. The Thiersch grafts were sprinkled thickly with iodoform, and the first dressing was left in position for six days.

He next speaks of hydrochlorate of scopolaminum, which in 0.2 per cent. solution has the effect of 1 per cent. atropine solution.

Finally he states that the numbers of the lenses have been changed in his sciascope. He now employs − 1, − 2, − 4, − 8, and + 1, + 2, + 4, + 8, by which all combinations between 1 and 15 are rendered possible. WESTHOFF.

It was a happy idea of KÖNIG (566) to collect the treatises which led up to the invention of the ophthalmoscope, and to publish them anew with Helmholtz's papers. The treatise of Cuming, now out of print, is especially welcome as completing this series of papers of such extraordinary historical interest.

The first part of CZERMAK'S (567) welcome and promising book on ophthalmic operations contains good illustrations of all the instruments used by the oculist, and the beginning of the chapter on anti- and a-sepsis.

EVERSBUSCH (569) has given us a description, with interesting details, of the new university eye-clinic in Erlangen, which was constructed for the most part in accordance with his ideas. It may be regarded as a model clinic, and the description arouses the desire to see the building itself.

DIMMER'S (570) *Ophthalmoscope and Ophthalmoscopic Diagnosis* appears in an enlarged second edition. Some portions are re-written, and others expanded. The chapter on sciascopy is new.

The Presbyterian Eye, Ear, and Throat Hospital of Baltimore —Dr. CHISOLM (575)—entered 7295 new eye patients in 1892. Cataract extractions—92 simple, 27 combined, 3 with capsule. BURNETT.

In the Maine Eye and Ear Infirmary (576) for 1892 there were admitted 732 new eye patients. There were 37 extractions, all simple except one. There were three failures. BURNETT.

In the 13th Annual Report of the Newark Eye and Ear Infirmary (577) there were recorded 3473 new eye cases. There were 36 extractions. BURNETT.

II.—GENERAL PATHOLOGY, DIAGNOSIS, AND THERAPY.

578. NUEL. Report on asepsis and antisepsis in ophthalmic operations. *Soc. franç. d'opht.*, May, 1893.

579. WEEKS. A case of microphthalmus with entire absence of the lens and lens-capsule. *New York Eye and Ear Infirmary Reports*, part 1.

580. Bull. Case of traumatic irido-choroiditis from contusion of the eyeball, ending in the development of intraocular glioma. *Trans. Amer. Ophth. Soc.*, 1892.

581. Kollock. The eye of the negro. *Ibid.*

Nuel's (578) 66-page report was sent to the members of the French Ophthalmological Society two months before the meeting, so that the session might be commenced with the discussion. The report is in four sections :

1. The limits of the action of chemical antiseptics ;
2. Asepsis of the patient ;
3. Asepsis of the instruments ;
4. Asepsis of the dressings.

In the introduction the proposition is laid down that in operations performed *lege artis*, infection is the only complication to be feared.

The chemical antiseptics which may be employed on living tissues do not give a perfect sterilization of the field of operation, but a relative, though sufficient one. In living tissues antiseptics are quickly absorbed or chemically altered. This fact and the necessity of avoiding irritating substances render absolute sterilization in ophthalmology impossible.

Antiseptic precautions in the case of a healthy eye in a healthy individual : A bath, a laxative, repeated washing of the region about the eye with soap, followed by antiseptic irrigation particularly of the lid margins, wiping out the conjunctival sac with absorbent cotton dipped in an antiseptic fluid. Nuel uses sublimate 1:2000 as an antiseptic, slightly heated, in order to increase its action. The regularity of the corneal section, the delicacy with which the operation is done, and the reposition of the iris contribute in considerable measure to the attainment of an aseptic recovery ; while syringing the anterior chamber is unnecessary when done with indifferent fluids, and dangerous by its irritation when done with actual antiseptics. During and after the operation the reporter advises the use of sterilized physiological salt solution and sterilized gauze. Forty-eight hours after the operation the dressing should be changed, the eye not being opened when no secretion is present and everything appears normal.

Antiseptic precautions in complicated cases : We pass by general diseases, taking into consideration affections of the nasal cavities, the lachrymal passages, and the conjunctiva. All these affections require long-continued treatment, and in lachrymal-sac diseases a complete cure cannot always be expected. The reporter, however, does not approve of the cauterization of the lachrymal puncta or of stopping the canaliculi. In order to ascertain whether an eye may be operated on without danger of infection, he recommended applying an aseptic pressure bandage. If after two days there be no secretion or injection, the operation may be undertaken.

For sterilization of instruments he recommends the steam sterilizer of Ostwalt, and for dressings, a simple steam sterilizer.

Discussion: Chibret (Clermont-Ferrand) criticised the author's inexact definition of the fundamental principles. With the words "sterile" and "aseptic" we characterize the condition of absence of micro-organisms and their spores, with "antisepsis" the sum of the precautions employed to obtain the above-named condition. He wished to see cyanide of mercury 1:1500 solution, which does not coagulate albumen, given a place as an antiseptic.

Panas (Paris) before he began to syringe the anterior chamber, had infection even when the corneal wound healed well; syringing with boric-acid solution had prevented infection without causing symptoms of irritation or opacity of the cornea.

Gayet (Lyons) spoke in favor of washing out the anterior chamber; in order to prevent glaucoma the fluid should be heated to 38°.

Sulzer (Geneva) advised disinfecting the dressings by a temperature of 120°. Absolute disinfection should always be preferred to relative, when it may be done without injury, as in the case of dressings. SULZER.

The most marked peculiarity of WEEKS' (579) specimen was the total absence of the lens and capsule. All the other tissues were present in a more or less rudimentary state, and there was an apparent coloboma of the iris, though the cilary body and choroid seemed intact. There were also some peculiarities of the cornea next to Descemet's membrane. BURNETT.

In BULL'S (580) patient, a girl of three years received a blow on the eye, which was immediately followed by irido-choroiditis with what appeared to be an exudation, causing a detachment of the retina. This developed into a growth causing all the appearances and symptoms of glioma, which led, nearly a year after, to removal. Some months after, the growth reappeared in the orbit, and appearances pointing to a growth in the other eye showed themselves. Brain symptoms set in, and the child died comatose about four months after the enucleation of the eye. Under the microscope the growth gave the appearance of glioma.

(In the discussion, Dr. Mittendorf mentioned that the patient had consulted him before the injury and he had ascertained the presence of glioma in the same eye.—H. K.) BURNETT.

KOLLOCK (581) has studied the eye of the negroes in Charleston, S. C., and the islands adjacent, where they are of nearly pure blood. He thinks them, since the war, to be much affected with syphilis, the ravages of which are severe; in which opinion the reviewer cannot agree, so far as his observations in Washington allow. K. also finds trachoma frequent in the South Carolina negro, which is not the case in other portions of the United States. Corneal affections are frequent, and among the young of these negroes xerosis conjunctivæ is very common. Myopia is gradually increasing among them as they are becoming more cultured. BURNETT.

III.—INSTRUMENTS AND REMEDIES.

582. DARIER. Subconjunctival injections of sublimate. *Ann. d'ocul.*, cix., p. 241.

583. KOLLER. The subconjunctival employment of cocaine in eye operations. *Trans. Amer. Ophth. Soc.*, 1892.

584. RÄHLMANN. Hydrochlorate of scopolaminum, a new mydriatic, and its employment in ophthalmic practice. *Klin. Monatsbl.*, xxxi., p. 59.

585. SCHANZ. A corneal microscope. *Ibid.*, p. 99.

586. STROHSCHEIN. Antisepsis in eye operations in the Würzburg University eye clinic. *Graefe's Arch.*, xxxix., 1, p. 256.

587. MADDOX. The prescribing of prisms. *Ophth. Rev.*, xii., p. 37.

588. SCHWARZSCHILD. Ciliaroscope. *Med. Record*, Feb. 4, 1893.

DARIER (582) speaks of the historical development of the idea of the intraocular and subconjunctival injection of antiseptic fluids. From the published results he gives the indications and effects of this method of treatment, which seems to be daily increasing in popularity, both in traumatic infections and in dyscrasic infectious diseases. SULZER.

KOLLER (583) makes subconjunctival injections of 2-4 per cent. cocaine solutions for tenotomies and advancements, which are thus rendered painless. He has also employed this method for iridectomies and cataract extractions. BURNETT.

RÄHLMANN (584) recommends the use of the alkaloid scopolamin obtained from the root of the scopolia atropoides, as a mydriatic and antiphlogistic. It is employed in $\frac{1}{1000}-\frac{2}{1000}$ solutions. It has all the advantages of tropein without causing the unpleasant after-effects of atropin. It is of particular advantage in purulent inflammations of the anterior portion of the uveal tract.

SCHANZ (585) describes a corneal microscope, which is so constructed that it may readily be focused on the cornea, while the point observed may be illuminated obliquely.

STROHSCHEIN (585) describes the method of operative procedure now employed in the Würzburg clinic. In place of antisepsis, asepsis is employed before, during, and after the operation. In place of sublimate they use sterilized salt solution. Twelve hours before the operation the eye is closed with a moist sublimate dressing $\frac{1}{5000}$. Just before the operation this is removed and the exterior of the eye washed with soap and sterilized salt solution, and the conjunctiva wiped out with the salt solution only. The instruments are boiled, the dressings and solutions sterilized.

Forty-seven cataract cases so treated gave very satisfactory results. The irritation of the eye observed when sublimate is used, was absent, and the dressing could be left off after the third day.

MADDOX (587) recommends the following maxims in prescribing prisms : 1. Never order them unless the indications for their use are unmistakable. 2. Never order them simply for an anomaly of convergence with the tests unless there is asthenopia, etc. 3. Employ several tests, *e. g.* the "finger," "rod," or "card test" (see *Ophthalmological Prisms* by Maddox), and if necessary test the relative convergence. 4. Considerable latent deviation in distant vision is more important than in near vision ; there is physiologically moderate divergence in the latter. 5. Always more or less undercorrect with prisms. For vertical deviation, hyperphoria, the "rod" test is very reliable ; in simple non-paralytic hyperphoria the deviation is the same in all vertical positions, and it is impossible to say which eye is deviated. 10° was the highest amount of hyperphoria seen by the author; prisms relieved a defect of 10° which caused headache and discomfort. WERNER.

As an apparatus for viewing the ciliary body SCHWARZSCHILD (588) uses an apochromatic sphero-prism, the base being placed toward the pupil, which should be widely dilated. The illumination is furnished by an ophthalmoscope as usual.

BURNETT.

IV.—ANATOMY.

589. DURAND. The muscular structure of the iris. *Soc. de biologie*, Feb., 1893.

590. BARBARA BURBO. Studies on the relation between the curvature of the sclera and that of the cornea in the horizontal meridian. *Rev. gén. d'opht.*, Feb., 1893, p. 49.

591. KÖLLIKER. On the origin of the oculomotor nerve in man. *Sitzungsb. d. phys. med. Gesellschaft in Würzburg*, 1892, No. 8, 118.

DURAND (589) studied the vertebrate eye, beginning with the lower orders and going up to the higher. In birds dilating fibres are certainly present in the iris. They lie in two planes, the anterior containing coarse, the posterior fine, radiating fibres, extending from the ciliary to the pupillary margin. In the mammalia these fibres are wanting. SULZER.

BARBARA BURBO (590) endeavored to measure the curvature of the sclera in the horizontal meridian by means of Meyer's instrument. (This instrument, constructed after the principle of the hat-maker's conformateur, gives rapid but inaccurate measurements.—REVIEWER.) From numerous measurements the conclusion is drawn that the nasal side of the sclera is less curved than the temporal. SULZER.

In an eight-months fœtus KÖLLIKER (591) could readily follow the partial crossing of the fibres arising from the oculo-motor nucleus. The crossing was found only in the distal and lateral bundles and less markedly in the root-bundles passing through the red nucleus, while the longer the proximal bundles are, the more likely they are to arise from the nucleus of the same side. Which portion of the nucleus gives rise to the crossing fibres, whether the dorsal alone or the ventral as well, is too difficult to ascertain in man.

V.—PHYSIOLOGY.

592. Nahmacher. On the influence of reflex and central irritation of the optic nerve on the position of the cones in the retina of the frog. *Arch. f. d. gesammte Physiologie*, liii., p. 375.

593. Ziem. On transillumination of the eye. *Wiener klin. Wochenschr.*, 1893, Nos. 5 and 6.

594. Koller. The form of retinal images in the astigmatic eye. *Trans. Amer. Ophth. Soc.*, 1892.

595. Knapp. The law of symmetry of our eyes as manifested in the direction of its meridians ; its rule and its exceptions. *Ibid.*

596. Savage. Relationship between the centres of accommodation and convergence. *Ophth. Record*, May, 1893.

597. Burnett, Swan M. The general form of the human cornea and its relation to the refraction of the eye and visual acuteness. *Trans. Amer. Ophth. Soc.*, 1892.

598. Phillips, R. J. Some ocular perceptions, and how they are influenced by lenses. *Annals of Ophth. and Otol.*, Jan., 1893.

599. Eriksen. Corneal measurements. Aalius, 1893.

The large series of experiments performed by Nahmacher (592) showed that there are undoubtedly fibres in the optic nerve, which, being stimulated, cause a contraction of the cones in the retina.

Ziem (593) made transillumination experiments on the eyes of birds and mammals. An enucleated eye was held with its posterior pole to the sun or an artificial light and its cornea near the eye of the observer, and all the details of the fundus could be clearly seen. Ziem believes that this method of examination might be followed, by means of transillumination, for the demonstration of enucleated eyes, and for studying the fundus in the eyes of animals.

Koller (594) shows by calculation that the indistinctiveness of the retinal image in astigmatism is not necessarily associated with distortion, because of the slight difference in the position of the second nodal points of the two meridians. When the astigmatism is corrected by a cylinder placed some distance in front of the eyes, then this relation of the nodal points is changed and a distortion of the images occurs, which is so often resented by patients. Burnett.

Knapp's (595) paper is based upon an examination of 1000 cases of binocular astigmatism recorded in his private case-books during the last few years. Astigmatism he finds to constitute about 11.5% of his private practice. There were 305 cases of M. As., 259 H. As., 175 M. M. As., 224 H. H. As., 32 M. H. As., and 5 heteronymous.

The strongest meridian was *vertical* in both in 605 cases, *horizontal* in 110; *diagonal*, upper end to *nasal* side in 27, to *temporal* side in 16; *intermediate*, upper end to *nasal* side in 49, to *temporal* in 33. The unsymmetrical directions were *both sides nasally* deflected in 18, *temporally* 21; *vertical* in 1, *horizontal* in the other 13, *nasally* in 1, *temporally* in the other 8; *vertical* in 1, *nasally* in the other 33, *temporally* in the other 39; *horizontal* in 1 and *nasally* in the other 12, *temporally* in the other 16.

He suggests the terms homologous and heterologous (regelrecht and regelwidrig) as a substitute for "with the rule" and "against the rule." BURNETT.

The practical point in SAVAGE'S (596) paper is to show how, in heterophorias associated with refractive errors, it is necessary to modify the correction of the ametropia according to the state of the muscles. For example, it is necessary to give a full correction of H. when associated with esophoria, but only a partial correction when associated with exophoria, and contrariwise in M. The remaining muscular anomalies must be treated by rhythmical exercise or tenotomies. BURNETT.

BURNETT (597) examined 42 corneæ with the ophthalmometer of Javal along their principal axis at intervals of 5° from the visual axis to 15° or 20° towards the periphery. He finds that invariably the cornea diminishes more rapidly to the nasal side, it being, at 15° from the visual axis, often 4.5°, or less than at the visual axis. On the temporal side at 15° its average is 5° less; above and below it is usually a little more than this. The refraction of the cornea seems to have no sort of relation to the general refraction of the eye. BURNETT.

In this paper PHILLIPS (598) goes over the ground of ocular perceptions and shows how the change in the retinal images produced by spherical and cylindrical lenses and prisms gives rise to illusions. There is nothing specially new, but the subject is clearly and intelligently handled. BURNETT.

In his treatise ERIKSEN (599) speaks of the earlier instruments and methods employed for measuring the cornea, and reviews all the earlier papers published on the subject after the time of Jean

Louis Petit. After this he describes his own examinations made on twenty-four eyes for the purpose of finding the form of the cornea, not only in its central but also in its peripheric portions. His results are as follows:

1. The central portion of the cornea approximates a spherical form.

2. The cornea is in no manner an ellipsoid.

3. The curvature decreases in an increasing ratio as we pass from the centre to the periphery.

4. The radius of curvature increases rapidly and in increasing ratio as we pass from the centre to the periphery of the cornea.

5. The curvature is half as great and the radius of curvature twice as great in the periphery as in the centre (in meridional sections).

6. When there is central corneal astigmatism two points without astigmatism may be found in the highest refracting meridian.

7. The greater the central astigmatism and the more the central portion of the cornea approximates the spherical form, the farther apart are the two points that are free from astigmatism.

8. When there is central astigmatism, we find astigmatism of the same sort in the periphery of the least refracting meridian, and astigmatism of the contrary sort in the periphery of the most refracting meridian.

9. The greater the central astigmatism, the less usually is the astigmatism in the periphery of the most refracting meridian and the greater the astigmatism in the periphery of the least refracting meridian.

10. Usually the peripheric astigmatism has its greatest value in the most refracting meridian. SCHIÖTZ.

Sections VI.—XI. Reviewed by DR. HORSTMANN.

VI.—ANOMALIES OF REFRACTION AND ACCOMMODATION.

600. SULZER. Myopia in the schools of Geneva. *Rev. méd. de la Suisse Romande*, Jan., 1893.

601. HOOR. The development of myopia. *Zeitschr. f. Schulgesundheitspflege*, No. 4, 1893.

602. FALKENBERG and STRAUB. On the normal refraction of the eye and the hyperopia with congenital amblyopia. *Arch. f. Augenheilk.*, xxvi., p. 336.

603. Schweigger. Operative treatment of myopia of high degree. *Trans. Amer. Ophth. Soc.*, 1892.

604. Botto. Studies on the position and extent of Mariotte's blind spot in the myopic eye. *Ann. di Ottal.*, xxii., 1, p. 42.

605. Szili. A case of fundus astigmatism. *Prager med. Wochenschr.*, 1893, No. 9.

606. Maddox. Notes on paralyzing the accommodation for refractive purposes. *Ophth. Review*, xii., p. 129.

607. Jackson. The full correction of myopia. *Trans. Amer. Ophthal. Soc.*, 1892.

608. Burnett, Swan M. Some incidental phenomena of the shadow-test. *Ibid.*

609. Harlan. Constant correction of high myopia. *Ibid.*

610. Risley. The relative importance of astigmatism in the production of asthenopia. *Annals of Ophthal. and Otol.*, Jan., 1893.

611. Herron. Report of a case of sneezing due to an uncorrected error of refraction. *Ophthalmic Record*, Jan., 1893.

612. Harlan. Statistics of the direction of the principal meridians in binocular astigmatism. *Trans. Amer. Ophthal. Soc.*, 1892.

613. Oliver. The clinical value of repeated careful correction of manifest refractive errors in plastic iritis. *Ibid.*

614. Swasey. Astigmatism as an element of refraction. *Boston Med. and Surg. Journ.*, March 10, 1893.

615. Coleman. Does homatropine, as generally used, reveal the whole error of refraction? *Annals of Ophthal. and Otol.*, Jan., 1893.

616. Bigler. Anisometropia. *Journ. of Ophthal., Otol., and Laryngol.*, Jan., 1893.

617. Gould. A temporary change in the axis of astigmatism. *Med. News*, June 3, 1893.

618. Reynolds. A unit of measure of refraction. *Journ. of Ophthal., Otol., and Laryngol.*, 1893.

619. Park, Lewis. The uncertainty and insufficiency of homatropine hydrochlorate as a refractive cyclopegic. *Ibid.*

620. Sangree. Tic douloureux from visual defect. *Med. News*, May 27, 1893.

SULZER (600) found myopia in 430 of 2926 eyes examined. In 423, or 98.4 %, of the myopic eyes, the myopia was functional. The investigations as to heredity seemed to show that myopia is only indirectly inherited. The astigmatism is hereditary, which in a third of the cases of school-myopia seems to be the direct cause of the elongation.

In examining a great number of refraction-amblyopes FALKENBERG and STRAUB (602) found that a relatively large number of amblyopes have hyperopia of 1.5 or 2. D. After the use of atropine the average decrease in refraction was 1.1 D. The slight manifest hyperopia in amblyopic eyes was on the contrary not increased by the use of atropine.

SCHWEIGGER (603) made discission of the lens in fifteen cases of high myopia. In all the far point lay nearer than 7 *cm*, and concave glasses only corrected the myopia partially. When concave glasses are of service the operation is not indicated. The course was favorable in all, but the acuteness of vision was but little improved.

BOTTO (604) measured the blind spot in sixty persons with myopia of 6.D or more, and found that as a rule in myopia, particularly with a well-marked crescent, the dimensions of the blind spot are increased. In the majority of the cases the blind spot began 10–13° from the point of fixation, and in some 9 or 7°. The horizontal diameter was for most cases 5°, in some being as great as 13°. The vertical diameter, in the majority, was 5–7°, in some 13°. DANTONE.

SZILI'S (605) patient showed in each eye an inferior crescent. The refraction of the upper half of the fundus differed from that of the lower half by 3.–4. D in one eye, and by 5.–6. D in the other. HERNHEISER.

MADDOX (606) points out two conditions which tend to indicate hypermetropia, rendered latent by accommodation spasm, viz., (1) latent convergence of more than 1° for distance ; (2) a high angle a, easily ascertained by position of corneal reflection of ophthalmoscope mirror. WERNER.

JACKSON (607) is an advocate of the full correction of myopia in the general run of cases, the contra-indications being very few. He thinks the eye safer if made emmetropic, and gives the histories of twenty-seven cases which he has been able to follow for three or more years in support of his thesis. BURNETT.

BURNETT (608) has observed, in a number of cases examined by the shadow-test, considerable shadow within the illuminated area not unlike that caused by conical cornea. He also found that in these cases the "movements" of the shadow did not coincide with the refraction as found by glasses. He deems it due to some irregularity in the refracting media. Examination with the Javal ophthalmometer, however, showed the cornea in these cases to differ in no wise from the normal. Visual acuteness is nearly always reduced.

HARLAN (609) thinks it is not only safe but wise to approach as near a full correction as is possible in myopia of high degree. The cases he reports were from − 4 D to − 16 D, the average being − 8 D. He wishes to relieve the convergence as much as possible. BURNETT.

RISLEY (610) contends that the emmetropic eye is not only the ideal eye but the normal one, and argues that all forms of emmetropia should be reduced to it. BURNETT.

HERRON (611) reports a case of persistent sneezing for which no adequate cause could be found in the nose, but which was permanently relieved by the correction of H (2.5 D) with a slight astigmatism (0.5) in the left eye. BURNETT.

HARLAN (612) presented a table showing the direction of the meridians in 499 cases of binocular astigmatism found in 1200 cases of refractive errors recorded in Wills Eye Hospital. Among these 499, the axes were exactly symmetrical in 350 cases, symmetrical within 10° in 40, unsymmetrical—that is, they differed by more than 10°—in 109. BURNETT.

SWASEY (614) who is using Javal's ophthalmometer for the determination of astigmatism, considers it of great value, and thinks that it dispenses with the use of a mydriatic in the majority of cases. BURNETT.

COLEMAN (615) does not regard homatropine as efficient in paralyzing accommodation for refraction determination as atropine. BURNETT.

In 1600 cases of ametropia BIGLER (616) found 48 per cent. of H, 9 per cent. of M, 10 per cent. astig., and 33 per cent. of anisometropia. In the 482 cases of anisometropia there was a difference in the H of the two eyes in 101 cases: in M in 22; E in 1, and ametropia in the other 21 cases. In those cases where only one eye was astigmatic the axis was at 180° or 90° in 73 per cent. BURNETT.

In a case in which GOULD (617) had twice before tested the refraction, he found that the axis in one eye had changed from 70° to 110°. The cause was a Meibomian cyst, on the removal of which the axis returned to its former position. BURNETT.

REYNOLDS (618) proposes to take as a unit of refraction a glass having a focus of 240 inches or 20 feet, which is the far point of the emmetropic or standard eye. A glass of half that focus or double the strength would be No. 2; one one-third the focus, No. 3, etc. BURNETT.

PARK (619) gives tables showing the uncertainty and unreliability of homotropine as an agent for paralyzing the A. for refractive purposes. BURNETT.

SANGREE (620) reports a case of most intense and obstinate neuralgia of the face cured by correcting a low degree of astigmatism 0.5 D and 1. D. BURNETT.

VII.—LIDS.

621. MITVALSKY. A case of bilateral gangrene of the skin of the lids. *Zehender's klin. Monatsbl.*, xxxi., p. 18.

622. ELSCHNIG. On gangrene of the skin of the lids. *Ibid.*, xxxi., p. 191.

623. PARTSCH. Actinomycosis of the eyelids. *Centralbl. f. prakt. Augenh.*, 1893, p. 161.

624. GALLEMAERTS. Congenital cyst of the lid with microphthalmus. *Soc. des sc. méd. et nat. de Bruxelles*, 1892, Dec. 15.

625. CAPEI. Contribution to blepharoplasty for phagedenic epithelioma of the internal canthus. *Boll. d'ocul.*, xv., 3.

626. KUNN.. A suggestion for a blepharo-ptosis operation. *Wiener med. Wochenschr.*, 8–10, 1893.

627. SINCLAIR, W. N. Congenital ptosis with associated movements of the affected lid. *Ophth. Rev.*, xii., p. 80.

628. WEEKS. Restoration of the integument of the eyelids in a case of severe burn; with remarks. *N. Y. Eye and Ear Infirmary Reports*, part i.

629. FISHER, W. A. A syphilitic gumma of the upper eyelid resembling a dislocated lachrymal gland. *Journ. Amer. Med. Asso.*, June 3, 1893.

In a man æt. fifty-five, MITVALSKY (621) saw gangrene of the upper lids following facial erysipelas. The gangrenous parts sloughed off and the defects healed by cicatrization. Masses of streptococci were found in the pus.

In a woman with endometritis and septicæmia, all four lids became gangrenous. The patient died in two days. The affection might be explained as being due to bilateral septic emboli in the arterioles of the lids.

In two individuals that had lived in the house of a butcher, ELSCHNIG (622) observed gangrene of the skin of the lower lid. In the necrotic parts, besides numerous cocci, the bacilli of splenic fever were found.

GALLEMAERTS' (624) case was one of serous cyst of the left lower lid. The eyeball was reduced to a small stump lying in the depth of the orbit. The histological examination of the extirpated cyst revealed the presence of retinal elements.

After the extirpation of an ulcerated epithelioma situated at the inner canthus, being 2 *cm* broad and involving each lid to an extent of 5 *mm*, CAPEI (625) covered the defect with a flap taken from the back of the nose. The result was good. DANTONE.

In cases of ptosis, KUNN (626) makes a horizontal, straight, or slightly curved incision 5–10 *mm* above the margin of the tarsus through the skin and muscle. The skin is then dissected down to the margin of the tarsus and up to a point 1 *cm* above the upper orbital margin, exposing the frontalis muscle. The muscle is then cut through just above the supraorbital margin, and the cut margin united by several sutures with the tarsus, after which the skin incision is sutured.

SINCLAIR (627) records three cases, in all of which there existed congenital ptosis of the left eye, the drooping lid being involuntarily raised on opening the mouth. WERNER.

WEEKS' (628) case was one of severe burn of the eyelids of both eyes, which was treated with fair success by flaps transported from the arm according to the Wolfe method. The flaps shrank to about one fifth of original area. He tabulates thirty-seven cases of the same operation from various sources. There was a good result in eighteen cases. BURNETT.

In a case treated by FISHER (629), a girl of sixteen with interstitial keratitis, there appeared, rather suddenly, a tumor on the upper lid, freely movable, and capable of being pushed up into the lachrymal fossa. It was considered by many a dislocated lachrymal gland, but under the free and long-continued use of iodide of potassium it disappeared. BURNETT.

VIII.—LACHRYMAL APPARATUS.

630. TERSON. On the extirpation of the palpebral lachrymal gland. *Arch. d'ophth.*, xiii., 1, p. 33 (continuation).

631. Truc. Cases of extirpation of the orbital or palpebral lachrymal gland in simple or complicated obstinate lachrymation. *Arch. d'ophth.*, xiii., 5, p. 280.

632. Malbec. Hemorrhage from the lachrymal puncta following epistaxis. *Mercredi méd.*, 1893, 10, p. 114.

Malbec (632) observed the case of a woman of fifty-two who was suddenly taken with bleeding from the right side of the septum of the nose. After plugging the anterior nares the blood passed into the throat. Under violent efforts of the patient the blood passed through the lachrymal puncta and rolled down the cheek. Sulzer.

IX.—MUSCLES AND NERVES.

633. De Wecker. The modern operations for strabismus. *Arch. d'ophth.*, xiii., 1, p. 1.

634. Parinaud. Treatment of strabismus. *Soc. franç. d'opht.*, 1893, May, 1–4.

635. Grandclément. A simplification of muscular and capsular advancement. *Ibid.*

636. Motais. Theory of the surgical treatment of squint. *Ibid.*

637. Müller, L. Contributions to operative ophthalmology. *Zehender's klin. Monatsbl.*, xxxi.

638. Straub. Muscle strengthening by muscle folding according to Lagleyze. *Third Meeting of the Ophthalmological Society of the Netherlands*, 1892.

639. Lewuillon. Contributions to the study of amblyopia in convergent strabismus. *Annal. d'ocul.*, cix., p. 25.

640. Tscherning. Hansen-Grut's theory of strabismus. *Ibid.*, p. 33.

641. Ottara. An eye operation in a hemaphile. *Prag. med. Wochensch.*, 1893, No. 14.

642. Roth. The double images with paralyses of the ocular muscles in symmetrical arrangement. Berlin, 1893, Hirschwald.

643. Landolt. The secondary deviation of the false projection in paralyses of the ocular muscles. *Soc. franç. d'opht.*, 1893, May 1–4.

644. Nuel. Paralysis of the extrinsic muscles of the eye due to their hyaline degeneration. *Arch. d'opht.*, xiii., 2, p. 76.

645. Goldschmidt, D. A case of traumatic paralysis of the oculomotor nerve. *Wiener med. Wochenschr.*, 1893, No. 7.

646. Dalichow. Etiology and etiological diagnosis of oculomotor paralysis. Inaug. Dissert., Berlin, 1893.

647. Stoewer. A case of bilateral paralysis of the ocular muscles. *Deutsche med. Wochenschr.*, 1893, No. 17.

648. Uhthoff. A case of stationary homonymous diplopia in the sense of a divergence paralysis ; treated by tenotomy of a rectus. *Berlin. klin. Wochenschr.*, 1893, No. 16.

649. Barabaschew. Two cases of nuclear paralysis. *Wiener med. Wochenschr.*, 1893, No. 17.

650. Schlesinger. On the diagnosis of chronic nuclear ophthalmoplegia. Inaug. Dissert., Berlin, 1893.

651. Mauthner. Paralysis of the inferior oblique. *Wiener med. Blätter*, 1893, 18–20.

652. Fuchs, G. Traumatic paralysis of the inferior oblique with exophthalmus. *Wiener klin. Wochenschr.*, 1893, No. 16.

653. Nieden. Torticollis and paralysis of ocular muscles. *Centrabl. f. prakt. Augenheilk.*, 1893, p. 9.

654. Snell. Miner's nystagmus and testing for fire-damp ; a practical point.

655. Marlow. Some remarks on heterophoria and its treatment. *N. Y. Med. Jour.*, April 15, 1893.

656. Bernstein. The non-operative treatment of crossed eyes. *Ibid.*, April 22, 1893.

657. Hansell. The prominent symptoms of hyperphoria, as illustrated by 13 successive cases. *Trans. Amer. Ophth. Soc.*, 1892.

658. Pomeroy. On operations for divergent strabismus. *N. Y. Med. Jour.*, March 21, 1893.

659. Grüning. A case of affection of the cervical sympathetic nerve, with oculo-pupillary symptoms and anidrosis. *N. Y. Eye and Ear Infirmary Reports*, part i.

660. Savage. Rhythmic exercise the proper method of developing ocular muscles. *Ophth. Record*, May, 1893.

661. Ayres, S. C. Conservative treatment of strabismus convergens. *Amer. Jour. of Ophth.*, March, 1893.

662. Pomeroy. Some tenotomies of recti muscles for insufficiencies. *Trans. Amer. Ophth. Soc.*, 1892.

663. Caldwell, G. W. Two new operations for obstruction of the nasal duct. *N. Y. Med. Jour.*, May 27, 1893.

De Wecker (633) between 1883 and 1892 made 2306 squint operations, 1381 being capsular advancements, and 25 muscular advancements, the latter operation not having been done since 1888. He has come to the conclusion that in advancement or in setting back a rectus, the important element is not the detachment of the tendon, but the displacement of Tenon's capsule, and that capsular advancement is superior to every other squint operation. The tenotomy of the opposing muscle is cautiously made. De Wecker defends himself against the statements of his opponents that his method depends for its effect upon the Graefe or Knapp suture, and states that Motais' "avancement musculaire" and Lagleyze's "raccourcissement musculaire" are in fact only complicated methods of advancing the capsule. The setting back of Tenon's capsule is far more difficult to perform, and its effect is not readily estimated. The tendon of the rectus must be divided and sutured in its new position. In slight degrees of deviation he makes simple capsular advancement or the last mentioned operation. v. Mittelstädt.

According to Parinaud (634) the therapy of squint may be divided into the optical or functional and the surgical. The optical treatment consists chiefly in the employment of methods which facilitate, regulate, or give rise to binocular vision.

The functional optical therapy is directed only to the underlying cause of the squint,—the difficulty in accommodation or the disturbance of binocular vision. Two means are used for acting upon the accommodation, and through this on the convergence—correcting glasses and mydriatics, chiefly the former.

In the convergent strabismus of hyperopes Parinaud first uses atropine. This permits an accurate determination of the refractive error, and furnishes a valuable estimate of the effect of the dioptric treatment. Atropine should be used in both eyes for at least a week At times the squint increases as first. When the strabismus disappears under the use of atropine we may be sure that there is no retraction, and that the optical treatment will be successful.

The glasses must correct the total hyperopia and the astigmatism when the latter is present When the effect of the glasses is slow or insufficient, the desired result may sometimes be obtained by over-correcting a dioptry, which is well borne by children.

At times it will be found that a strabismus which reacted to atropine will not disappear at once with the glasses. This is the case when a low degree of astigmatism has been neglected in the correction. Often the results of optical treatment are only obtained in the course of months.

In the convergent squint of myopes, concave glasses are of service.

The means which affect binocular vision are of two sorts, those that facilitate binocular vision and those that produce it.

Prisms facilitate it. They do not act by exercising the muscles, but by facilitating the production of the condition of normal innervation of convergence. In the beginning of divergent strabismus in myopes, prisms base in with concave lenses are of service. In some cases of convergent strabismus it is advisable to use convex lenses with prisms base out.

Binocular vision is produced by the combination of the stereoscopic image formed on each retina. This department of strabismus therapy has been especially developed by Javal. The treatment falls into three phases :

1. The production of diplopia by shutting off the non-deviating eye.
2. Combination of the double images.
3. Extension of binocular vision in all positions of the visual lines.

Stereoscopic treatment is not always capable of curing the case, but it is of great value in producing binocular vision in cases where the deviation has been corrected by dioptric or surgical treatment.

The surgical treatment consists in the tenotomy and the advancement of the muscle, the setting back and the advancement of the capsule.

Indications : 1. Strabismus convergens. No case should be operated before the optical treatment has been thoroughly tried. The definite recovery, *i. e.*, that which continues after leaving off the glasses, occurs suddenly in some obstinate cases, about the age of puberty.

When glasses have been worn for several months without effect, operation should be resorted to. The setting back of the capsule should not be done in cases in which the deviation is not constant. 2. Strabismus divergens. Here the dioptric treatment is of less service. In marked cases muscular advancement will be necessary.

Javal, in the discussion, stated that he believed that every case of strabismus might be cured by optical treatment, but the therapy often requires too much time and patience.

When, after a tenotomy, an advancement is required, Grandclément's (635) procedure is as follows: With a broad fixation-forceps he seizes a broad and deep fold of the conjunctiva and the deeper tissues outward from the insertion of the muscle. Two needles on a single thread are passed through the fold, one on each side of the forceps, and the sutures knotted on the side toward the caruncle. The sutures are removed fifteen to twenty days later, when two solid cicatrices have been formed. The folding of the tendon and capsule so produced has the same result as an advancement. Sulzer.

Motais (636) believes that Tenon's capsule plays the chief rôle in squint operations. Sulzer.

In convergent strabismus when abduction is poor, and in divergent strabismus of more than 4 *mm* Müller (637) excises a portion of the muscle and makes advancement.

Straub (638) performed Lagleyze's modification of De Wecker's capsular advancement in four cases with success.
Westhoff.

Ottara (641) made an ordinary squint operation on a patient of seventeen. The following day the patient appeared with blood-soaked dressings. There was suffusion of the lids, marked bloody infiltration of the conjunctiva, and exophthalmus. The cornea and the pupillary reaction were normal. Three days later he found blood in the anterior chamber and complete blindness. The bleeding was only definitely checked after 8½ months, while the exophthalmus lasted 6 months and then gave place to an atrophy with symblepharon. Herrnheiser.

Landolt (643) calls attention to the fact that the binocular motility field in muscular paralysis is much smaller than the extent of the monocular field would lead one to suppose. Sulzer.

Nuel (644) observed the following remarkable case: A customs official, æt. forty-one, was thrown down, without losing consciousness, by a stroke of lightning. Soon after he noticed occasional diplopia. Later the right eye became immobile, and was pushed forward by a nodular tumor-mass behind and movable with the eyeball. $V = \frac{5}{6}$. No other anomaly. The mobility of the left eye was limited, except downward and inward; no exophthalmus.

The tumor behind the right eye was removed, and proved to be muscle. The contractile substance had almost disappeared The sarcolemma, the interstitial tissue, and the vessels showed a hyaline degeneration with great increase in volume. The cause of the affection, which at first simulated a nuclear paralysis, is unexplained. V. MITTELSTÄDT.

GOLDSCHMIDT (645), in a patient who had shot himself in the mouth, observed a left total oculomotor paralysis with detachment of the retina, opacity of the vitreous, and concentric contraction of the field of vision. The ball lay in the cranial cavity.

In BARABASCHEW'S (649) first case there was an isolated traumatic nuclear paralysis of the trochlearis, due to a fall on the occiput. The cause was probably a hemorrhage in the nucleus. In a second case there was an isolated paralysis of the intrinsic muscles of the eye after a fall on the head.

MAUTHNER (651) observed a case of paralysis of the right inferior oblique, and calls attention to the marked difference in the height of the double images in the extreme diagonal positions, which is much greater than that found in paralysis of the superior rectus or oblique.

FUCHS (652) reports the case of a forester who was injured in the region of the left eye by a stag. He showed a paralysis of the inferior oblique, with exophthalmus. The diagnosis was fracture of the orbital wall. For the relief of the diplopia, tenotomy of the superior rectus of the other eye was done, with good result.

SNELL (654) points out how nystagmus may interfere with the work of miners whose duty it is to test for the presence of gas in the mines. WERNER.

From a study of ten cases, whose histories are given in full, MARLOW (655) feels warranted in concluding that the variety of heterophoria has very rarely any relation to the kind of refractive error, and that heterophoria is only exceptionally influenced by the correction of the refractive error ; that in some cases prisms correct the anomaly satisfactorily, and in others only tenotomies will do this, and that the position of rest can be changed by a strictly partial tenotomy. BURNETT.

BERNSTEIN (656) gives the histories of twelve cases of squint, convergent and divergent, which he has treated successfully by the non-operative method. This consists in complete and constant correction of ametropia under atropine, and in children who are not in school a weak solution of atropine to keep the A in a state of paresis. The defective eye is to be used alone some every day.

BURNETT.

In two of Hansell's (657) cases of hyperphoria the symptoms were purely local, one being an increased flow of tears. Photophobia in five cases, reflex symptoms in six cases, chiefly headache; vertigo in six cases; dyspepsia in two cases; excessive nervousness and irritability of temper in four cases. Most of these were cured or improved by prisms or tenotomies.

Burnett.

Pomeroy (658) records twenty-five operations for divergent squint, most of them being advancements. He is inclined to think, however, that, except in cases due to weakening of the interni by previous operations, most cases can be cured by section of the externi and drawing the eye strongly inward by sutures over the nose. Burnett.

The specially notable feature in Gruening's (659) case is that after a simple exposure to changes of temperature there was a permanent affection of the cervical sympathetic in which the symptoms at the beginning were those of constriction and not of dilatation of the pupil as is usual. Burnett.

Savage (660) thinks the only proper way to develop a weakened ocular muscle is by rhythmical exercise, and not by a continuous mild exertion or a violent one made at long intervals. The recti muscles are exercised by weak prisms, or by simple strong convergence in the case of the interni, for five seconds at five seconds' interval, for five minutes three or four times a day. The obliques are exercised by the use of cylinders which are put with their axes out of their normal position, which necessitates on the part of the weak oblique muscle an exertion to bring the axes of the eye into their proper relation. Burnett.

Ayres (661) is opposed to tenotomy for strabismus in children, without having tried for two or three years the full correction of the ametropia by glasses. He thinks in this way a very large number of squints will be cured and the dangers of over-correction by operation will be avoided. Burnett.

Though Pomeroy (662) thinks that most cases of insufficiency will be relieved by a correction of the ametropia a number will not, and he gives the histories of fourteen cases in which he made tenotomies with most satisfactory results. Burnett.

Caldwell (663) thinks that the canaliculus should be preserved intact whenever possible in all operations on the nasal duct. He therefore introduces a small probe through the upper canaliculus into the sac, and making the mucous membrane taut with it cuts into the sac at that point. Through this incision he treats the disease of the sac or duct by injections or probes. The probes he uses are bulbs of varying sizes on the ends of stiff wires. BURNETT.

X.—ORBIT AND ACCESSORY CAVITIES.

664. MÜLLER. Neuritis retrobulbaris with protrusio bulbi. *Zehender's klin. Monatsbl.*, xxxi., p. 24.

665. BOÀS. Clinical and anatomical contribution to the knowledge of orbital phlegmon. *Ibid.*, p. 75.

666. MEYER. Serous tenonitis caused by a cysticercus. *Rev. génér. d'opht.*, 1893, p. 157.

667. TENER. Extirpation of a cavernous tumor of the orbit. *Prager med. Wochenschr.*, 1893, No. 14.

668. MITVALSKY. On blood cysts of the orbital and subconjunctival cellular tissue. *Centralbl. f. prakt. Augenheilk.*, 1893, p. 1.

669. WALTER. Angioma of the orbit. *St. Petersburger med. Wochenschr.*, 1893, No. 7.

670. TERSON. A cyst of the orbit, probably hydatid, with exophthalmus ; puncture with an aspirating needle ; recovery. *Ann. d'ocul.*, cix., p. 161.

671. LAGRANGE. Melanotic tumor of the orbit. *Soc. franç. d'opht.*, 1893, May 1–4.

672. ELSCHNIG. Demonstration of a sarcoma removed from the orbit with preservation of the eyeball. *Wiener med. Presse*, 1893, No. 14.

673. HUTH. A case of bilateral anophthalmus. *Arch. f. Augenheilk.*, xxvi., p. 138.

674. BACH. Exophthalmus, abnormal pupillary reaction, and disturbances of the ocular muscles after lead intoxication. *Ibid.*, p. 218.

675. HOPPE. A contribution to the knowledge of disease of the frontal sinus. *Zehender's klin. Monatsbl.*, xxvi., p. 160.

676. GROSSMANN. On visual disturbances due to affections of the nose and accessory cavities. *Allgem. Wien. med. Zeit.*, 1893.

677. HOLT. Orbital cellulitis, the inflammation spreading to the temporal region, thence to the neck, obstructing deglutition, extending to the brain, and producing death ; with remarks upon

the same, and brief reports of five other cases. *Trans. Amer. Oph. Soc.*, 1893.

678. Lewis, Frank M. Osteoma of the orbit. *Med. Record*, May 27, 1893.

679. Smith, Stephen. Gunshot wound of the orbit. *Med News*, May 6, 1893.

680. Alt. A case of symmetrical invasion of both orbits probably by an intracranial sarcoma. *Amer. Journ. of Oph.*, March, 1893.

681. Callan. Nine cases of orbital traumatism resulting in immediate monocular blindness through fracture into foramen opticum; in one the blow was over the left orbit, causing blindness in the right eye. *N. Y. Eye and Ear Infirmary Reports*, part i.

682. Caldwell. Diseases of the pneumatic sinuses of the nose, and their relation to certain affections of the eye. *Med. Record*, April 8, 1893.

Müller's (664) case was a policeman, æt. fifty-three, who was seized with a pain in the right orbit. Vision decreased and exophthalmus developed. The ophthalmoscopic condition was normal. After the exophthalmus disappeared the disc showed an atrophic discoloration.

Boas (665) described a case of orbital phlegmon after inflammation of the tear sac, with involvement of the retina and optic nerve. The orbital affection disappeared, but the optic nerve and retina became atrophic. The primary affection was beyond a doubt the inflammation of the tear sac, which spread to the periosteum of the orbit and then attacked the cellular tissue. The swelling of the orbital contents interrupted the blood circulation in the optic nerve and led to inflammation of the nerve and retina.

The second case was a woman with periostitis. An orbital phlegmon developed first on the right side, then on the left. Cerebral symptoms followed, with death due to multiple cerebral abscess. In this case the extension was along the veins.

Tener (667) extirpated a cavernous tumor of the orbit, which did not lie within the muscle cone, but anteriorly and laterally. The ball was preserved. Herrnheiser.

Mitvalsky (668) removed from the orbit of a child of two years a thin-walled nodular blood-cyst, the size of a hazel-nut.

Walter (669) saw an angioma lying outside the muscle funnel. It was removed with preservation of the eyeball.

Terson (670) in 1878 observed a large orbital cyst which was permanently cured by incision. The contents consisted of a creamy fluid, with numerous fat globules, but no pus cells.

In 1892 he was consulted by a patient, æt. thirteen, with a marked swelling in the left orbital region, of four months' standing. The eye was displaced outward and downward. $V = \frac{1}{20}$. Marked optic neuritis. The regular form and the consistence of the tumor suggested cyst, but no fluctuation could be obtained. The needle of a hypodermic syringe was introduced and 20 *ccm* of a clear fluid were removed. The eye regained its normal position, and vision returned in a few days.

The fluid contained neither hooklets nor daughter cysts, but the chemical examination left no doubt as to its nature.

Sulzer.

Lagrange (671) extirpated a melanotic tumor of the orbit, the color of which was due to blood pigment. Perl's reaction colors hæmatin blue, but does not affect choroidal pigment.

Sulzer.

Elschnig (672) removed a sarcoma with a cystic degeneration from the orbit of a woman æt. forty-one, preserving the eyeball.

Huth's (673) case was an infant of six weeks, with a cleft palate and double harelip. There was no eyeball in either orbit, but a small nodule beneath the lower lachrymal puncture, which was taken to be a rudiment of the ball.

In a man, æt. forty-five, Bach (674) saw bilateral exophthalmus and ptosis. Besides these, there were paralysis of the right internal rectus, marked paresis of the right superior and inferior recti, and slight paresis of the left external rectus and superior oblique. In ordinary daylight the pupils responded to light and accommodation. Under excitement the right pupil exhibited oscillations and gradually dilated. In this case there was lead intoxication affecting certain portions of the medulla oblongata.

Hoppe (675) described a case of empyema of the frontal sinus with exophthalmus, in which death occurred from purulent meningitis; and a case of caries of the roof of the orbit with the opening of the frontal sinus.

Holt's (677) case was in a deaf-mute, of eighteen years, whose trouble began in the left eye after getting a foreign body in it. There were indefinite histories of slight traumatism previously. The usual symptoms of orbital cellulitis were manifest within a few hours, accompanied by very high temperature (104°), and symptoms pointing to brain complication. The inflammation extended beyond the orbit to the temple and down the neck. He died on the 12th day after the attack. There was no autopsy. Short notes of five other cases of orbital cellulitis are added.

BURNETT.

In LEWIS' (678) case a man of twenty-seven years had two rather slight injuries to the head near the right orbit. There was a gradually increasing exophthalmus; the movements of the eye were good in all directions except upward. $V = \frac{20}{70}$, with some papillitis; media clear. Tumor situated above and extending behind the ball. It was removed by chiselling at its base, and was found to be of ivory hardness. There was no pedicle. It measured 45 by 24 *mm.* Considerable reaction for some days after the operation, the final recovery was good, but there was atrophy of the disc. BURNETT.

In a case of gunshot wound of the orbit, SMITH (679) has demonstrated that the telephone bullet-probe is an instrument of great precision in detecting the presence of the ball, and, as shown by post-mortem examination, the blindness which follows such injuries does not necessarily depend upon a direct injury of the optic nerve. BURNETT.

ALT (680) saw a boy of twelve and a half years four months after he had fallen from a shed and fractured the temporal bone over the right orbit. There was at this time exophthalmus, and a tumor was felt in the orbit behind the trochlea. No papillitis. This tumor increased rapidly, and in a month made its appearance under the conjunctiva of the protruded eye. He died about a month after. No autopsy. BURNETT.

In about two years CALLAN (681) has seen nine cases of traumatism about the orbit which led to immediate monocular blindness, and that through fracture of the optic foramen. There was in every case an atrophy of the optic nerve visible on the disc after a variable length of time. BURNETT.

From his observations and experience CALDWELL (682) concludes that diseases of the ethmoid are more especially manifested in intraocular and conjunctival circulatory disturbances and in the production of asthenopic symptoms, while diseases of the sphenoid are more likely to affect the optic nerve and the motor nerves of the bulb. BURNETT.

XI.—CONJUNCTIVA, CORNEA, SCLERA, ANTERIOR CHAMBER.

683. UHTHOFF. A case of croupous conjunctivitis with a rapid, favorable course; demonstration of the presence of virulent diphtheria bacilli. *Berl. klin. Wochenschr.*, 1893, No. 11.

684. ELSCHNIG. Croupous conjunctivitis. *Mitth. des Vereins der Aerzte in Steyermark*, April 10, 1893.

685. MUTTERMILCH. On the nature of trachoma. *Ann. d'ocul.*, cix., p. 11.

686. TROUSSEAU. The surgical and mechanical treatment of granulations. *Arch. d'opht.*, xiii., 4, p. 233.

687. PHILLIP. On the treatment of trachoma in the garrison hospital in Budapest. *Wiener klin. Wochenschr.*, 1893, No. 16.

688. TENER. Trachoma in the Austro-Hungarian army. *Klin. Zeit- und Streitfragen*, x., 9–10.

689. ABADIE. The surgical treatment of trachoma in Egypt. *Soc. franç. d'opht.*, 1893, May 1–4.

690. BONFIGLIO. Volkmann's spoon in the treatment of trachoma. *Boll. d'ocul.*, xv., 3.

691. WESTHOF. The treatment of trachoma. Amsterdam, 1893.

692. PETERS, A. On the therapy of some chronic conjunctival affections. *Graefe's Archiv*, xxxix., 2, 254.

693. CHIBRET. Spring catarrh considered as an attenuated form of trachoma. *Rev. gén. d'opht.*, 1893, No. 3, p. 97. [The mitigated nitrate-of-silver stick energetically applied to the affected points of the conjunctiva and limbus rapidly cures the disease (?)]

694. UHTHOFF. A case of pemphigus of the conjunctiva. *Berl. klin. Wochenschr.*, 1893, No. 16.

695. PREGEL. Tuberculosis of the conjunctiva. *Wiener med. Wochenschr.*, 1893, No. 9–12.

696. GORECKI. Lymphadenoma of the bulbar conjunctiva. *Soc. d'opht. de Paris*, 1892, Dec. 6.

697. GOLDZIEHER. Lymphoma of the conjunctiva. *Pester med.-chir. Presse*, xxix., No. 10.

698. KAMOCKI. Studies in hyaline degeneration of the conjunctiva. *Beitr. z. Augenh.*, 1893, part 8.

699. Gallenga. Observations on the cysts that are found in pterygia. *Rass. di Scienze med.*, vii., 1.

700. Cross. Pemphigus of the conjunctiva. *Trans. Ophthal. Soc. Un. K.*, xii., p. 58.

701. Stephenson. The surgical treatment of trachoma. *Ophth. Rev.*, xii., p. 1.

702. Adams, P. T. A special form of ophthalmia to which hop pickers are liable. *Brit. Med. Journ.*, May, 1893, p. 1000.

703. Dodd. Tubercular disease of the conjunctiva with infiltration of the cornea affecting the left eye. *Trans. Ophth. Soc. Un. K.*, xii., p. 61.

704. Schwartzschild. Mucous patch of conjunctiva, complicated by a pseudo-membrane. *Med. Record*, April 22, 1893.

705. De Schweinitz. Large pterygium and moderate symblepharon following a lime burn; removal and successful transplantation of a Thiersch skin-graft upon the bulbar conjunctiva (Hotz's operation). *Annals of Oph. and Otol.*, April, 1893.

706. Hotz. On the use of Thiersch skin-grafts as a substitute for conjunctiva. *Annals of Oph. and Otol.*, April, 1893.

707. Montgomery. Nitrate of silver treatment of purulent conjunctivitis. *Annals of Oph. and Otol.*, Jan., 1893.

Uhthoff (683) observed a mild case of croupous conjunctivitis in the left eye of a girl of five, which recovered in two weeks. The bacteriological examination showed staplylococci and streptococci, long bacilli, and bacilli forming small grayish-white colonies with a central depression. These latter, according to Fränkel, were diphtheria bacilli. Inoculated in the cornea of a rabbit they produced a severe diphtheritic conjunctivitis with complete destruction of the eye.

Elschnig (684) observed a case of croupous conjunctivitis in a child of eight months, where true diphtheria bacilli were found.

Histological studies have led Muttermilch (685) to the conclusion that previous definitions of trachoma are incorrect. Follicle formation may be due to any conjunctival irritation, and has no pathological significance. Infection with the secretion of severe granular inflammation often produces only a slight conjunctivitis. Trachoma develops in predisposed individuals in consequence of various conjunctival inflammations. The predisposition lies in the permanent infiltration of the adenoid tissue due to continuous irritation of the conjunctiva, and producing nutritive disturbances in the epithelium. The cylindrical epithelium becomes pavement. The intermediate stage between the normal cylindrical epithelium and the pavement epithelium is the condition usually designated trachoma (conjunctivitis granulosa, as opposed to folliculosis). With the transformation of the epithelium occurs a sclerosis of the adenoid tissue. The initial infiltration of the adenoid tissue may be diffuse and is not necessarily accompanied by follicle formation. SULZER.

TROUSSEAU (686) finds in his experience that the late methods of treating trachoma and particularly that of Darier-Abadie do not give so radical or so quick a cure as he had been led to believe. In moderate cases he found the time of treatment abridged, but in severe cases he obtained a radical cure but once. The mechanical treatment of Hippel and Knapp had pleased him better. In some cases he obtained results more rapidly with mechanical means, in some more rapidly by therapeutic.

MITTELSTÄDT.

PHILLIP (687) recommends isolation and cleanliness in the treatment of trachoma patients. In the acute stage, he uses a two per cent. solution of silver ; when the conjunctiva is relaxed, strong sublimate solutions ; in excessive follicle formation, expression ; in velvety condition of the conjunctiva, the copper stick. Particularly good results were obtained by using Knapp's roller forceps. In 1892, 190 trachoma patients were treated, with recovery in 183.

ABADIE (689) obtained good results from grattage in the endemic Egyptian trachoma. It is necessary to ectropionize the upper lid until the retro-tarsal fold is exposed in its entire extent. Coppey used grattage with advantage ; it is contra-indicated when there is purulent secretion and in succulent granulations. Sulzer called attention to the prevalence of the purulent form in the East. SULZER.

BONFIGLIO (690), an advocate of the surgical treatment of trachoma, recommends the use of Volkmann's sharp spoon.

DANTONE.

WESTHOF (691) reports that in some of the Amsterdam schools twenty-five per cent. of the pupils have trachoma. The poorer classes should be taught the extreme contagiousness of trachoma and the necessity of early treatment.

Trachoma should be legally recognized as a contagious disease, and schools should be provided where trachomatous children could be taught and treated hygienically. WESTHOF.

In chronic granular conjunctivitis, PETERS (692) obtained good results from simply scraping the conjunctiva, the subjective symptoms being relieved and the pathological processes being favorably influenced. In spring-catarrh the symptoms were relieved, but the swelling was not affected. In chronic dry catarrh the procedure is of value. He does not use an antiseptic but simply scrapes the conjunctiva.

PREGEL (695) described a case of primary tuberculosis of the conjunctiva.

GORECKI (696) showed preparations of a lymphadenoma of the bulbar conjunctiva mixed with sarcomatous elements. He states that in general the prognosis of lymphadenoma is more favorable than is generally supposed. A case that he operated fifteen years ago, had not shown a relapse. SULZER.

After examining five cases of hyaline degeneration of the conjunctiva, KAMOCKI (698) divides them into two classes. In the first, the walls of the vessels are chiefly affected, causing occlusion of the vessel lumen and the formation of large homogeneous hyaline globules. In the second class, the adventitia of the vessels is the starting-point for a diffuse proliferation of adenoid tissue. Clinically we find a drooping and thickening of the lid; the conjunctiva is anæmic, opaque, and of yellowish or chalky-white color. The appearance is similar to that of the cicatricial stage of trachoma. It is not contagious, and the etiology is uncertain.

GALLENGA (699) gives a detailed histological description of four pterygium cysts. These were always in the middle of the pterygia, opposite the limbus, and may be considered a simple dilatation of the lymphatic vessels of the stretched conjunctiva. The author saw three cysts in 167 pterygia in a total of 7800 cases of eye disease. DANTONE.

CROSS (700) describes in his case the usual shrinking of the conjunctiva, leading to symblepharon and entropion with marginal vascularity of the cornea. Patient was a woman æt. forty-seven, who had pemphigus involving the skin and mucous membranes (mouth and pharynx). WERNER.

STEPHENSON (701) adopts the plan of EXPRESSING the granulations, in follicular disease, recent trachoma, and finds it sometimes useful in old chronic cases. He uses a roller forceps, the rollers being only half the length of Knapp's, with twice the diameter. [By a typographical error in my first publication the length of the cylinder was given too great. A greater thickness of the cylinder than 1.5 to 2.0 *mm* makes the instrument unwieldy without adding to its efficiency.—H. K.]

Excision of the cul-de-sac was performed thirty-seven times with only one untoward result from scarring; in some cases it seemed to benefit the ptosis. He employs it in chronic trachoma not benefited by other treatments. WERNER.

This is a form of acute conjunctivitis (702) accompanied in severe cases by keratitis and hypopyon, occurring chiefly in women and children employed in picking hops; the author believes it is caused by the hairs on the bracts and catkins of the hop plant. WERNER.

DODD'S (703) patient, æt. fifteen, presented a cock's-comb-shape mass of granulation on the palpebral surface of lower lid. Cornea was vascular. The child had evident tubercular disease of glands and bones. WERNER.

In a young woman with a syphilitic history SCHWARTZSCHILD (704) saw on the conjunctiva of the lower lid a mucous patch 12 *mm* long, 2 *mm* wide, and raised ½ *mm* above the surface. Moreover this was covered with a croupous exudation. The mucous patch was excised and the patient made a good recovery.

BURNETT.

In his case of pterygium and symblepharon DE SCHWEINITZ (705) supplied the deficiency in the conjunctiva by a skin-graft from the inside of the forearm with the result of relieving the symblepharon. BURNETT.

HOTZ (706) has used successfully the skin-grafts of Thiersch for all those defects of the conjunctiva in which hitherto the conjunctiva of the rabbit has been employed. BURNETT.

MONTGOMERY (707) thinks the stronger solutions of nitrate of silver are demanded in the later stages of purulent conjunctivitis, and recommends grs. lx. to cxx. ad ℥ i. once daily.

BURNETT.

708. TRUC. Clinical contribution to the pathogeny of lachrymal keratitis. *Arch. d'opht.*, xiii., 3, p. 129.

709. ELIASBERG. Double non-vascular parenchymatous keratitis of blennorrhagic origin. Complete cure. *Ibid.*, xiii., No. 2, p. 137.

710. PANAS. Neuro-paralytic keratitis. *Rec. d'opht.*, 1893, No. 2, p. 48.

711. MEYER. Note on a particular form of infectious keratitis. *Rev. génér. d'opht.*, 1893, p. 4.

712. HALTENHOFF. Traumatic dendritic keratitis. *Ann. d'ocul.*, cix., p. 258.

713. NUEL. Filamentous keratitis. *Arch. d'opht.*, xiii., 4, p. 193.

714. HESS. Clinical and anatomical studies on filamentous keratitis and some related corneal inflammations. *Graefe's Arch.*, xxxix., 2, p. 199.

715. MÜLLER. Corneal process with paralysis of the trigeminus. *Wiener klin. Wochenschr.*, 1893, No. 25.

716. BIRNBACHER. Two cases of atypical lime precipitation in the cornea cured by chemical means. *Zehender's klin. Monatsbl.*, xxxi., p. 103.

717. RUMSCHEWITSCH. On corneal neoplasms. *Ibid.*, p. 50.

718. BASINELLI. On two cases of ocular disease cured in the ophthalmic clinic in Rome, 1893.

719. CHEVALLEREAU. Treatment of keratoconus. *Soc. franç. d'opht.*, 1893, May 1–4.

720. CRITCHETT. A case of conical cornea treated with the galvano-cautery without perforation of the cornea. *Trans. Ophth. Soc. Un. K.*, xii., p. 72.

721. DUNN. A case of keratitis dendritica. *Annals of Oph. and Otol.*, April, 1893.

722. MORTON. Dendritic ulceration of the cornea. *Ibid.*

723. ALT. A case of gumma of the sclerotic. *Amer. Journ. of Ophthal.*, March, 1893.

724. WEEKS. Peculiar pigmentation of the cornea. *N. Y. Eye and Ear Infirmary Reports*, part 1.

725. THOMPSON, J. T. Drawing of a case of gumma of the episclera. *Trans. Ophthal. Soc. Un. K.*, xii., p. 78.

TRUC (708) in many cases of scrofulous corneal inflammation found affections of the tear passages. Probing was often followed by immediate improvement.

ELIASBERG'S (709) patient was a man of twenty-two, free from syphilis. A year before, he had a gonorrhœa, followed by a prolonged inflammation of the knee. Four months after the latter a parenchymatous keratitis developed in one eye, and later in the other. MITTELSTÄDT.

MEYER (711) distinguished dendritic keratitis and herpes, and described a new form of corneal inflammation. It begins with a white central spot just beneath Bowman's membrane, 3–4 *mm* in diameter. There is no injection, pain, or photophobia. After the spot has ceased to extend it becomes surrounded by a transparent halo. Irritating therapy renders the disease progressive.

SULZER.

NUEL (713) finds the formation of corneal filaments to be the same after ulcers and injury as on the normal cornea. The filaments consist of spindle-formed epithelial cells twisted into a strand with a bulbous extremity consisting of modified and degenerated epithelium.

HESS (714) examined twenty-two cases of filamentous keratitis. In ten no cause could be found, in five there was superficial injury, in seven a moist sublimate or boric acid dressing had been used. The filaments are of epithelial origin, the extremities formed of degenerated corneal cells.

BIRNBACHER (716), in two cases where the superficial layers of the cornea were incrusted with phosphate of calcium, used 5 % hydrochloric acid neutralized with 5 % carbonate of soda, with good result.

BASINELLI (718) reports good results from iridectomy, repeated puncture of the apex of the cone, later the cautery and tattooing.

CHEVALLEREAU (719) recommends the use of the galvano-cautery in keratoconus.

In CRITCHETT's (720) case V. improved from $\frac{6}{24}$ to $\frac{6}{9}$.

WERNER.

DUNN (721) reports a case in which a typical keratitis dendritica was followed, ten days after the first appearance, by herpes on the skin of the lid, accompanied by severe pain. On the fifteenth day he made application to the ulcer of the galvano-cautery with the effect of relieving the pain. This was repeated every day with the same effect for ten days, when the ulcer had healed, leaving, of course, an opacity. BURNETT.

MORTON (722) reports two cases of dendritic ulceration, in one of which the pain was not severe, nor the disease protracted, while in the other it was very painful and continued for six weeks. In neither was the remaining nebula excessive. Used aristol with apparent benefit. BURNETT.

In a woman of thirty-five years ALT (723) saw a swelling of the sclera near the upper corneal margin of the left eye, which was necrotic at its apex. It was associated with secondary symptoms, and finally yielded to specific treatment. No symptoms referable to the iris or ciliary body are mentioned. BURNETT.

Weeks (724) reports a case of pigmentation of the cornea, following an injury of the eye from the stick of a needle, which induced a traumatic cataract. The periphery of the cornea for 1 *mm* is clear but the centre colored of a rusty brown. The eye was removed for pain and increased tension. Anterior chamber filled with what appeared to be blood clot. Cornea of normal thickness and pigment granules in substantia propria. These granules are about 1.5 *mm* in diameter. The author thinks that the substance entered the cornea as a soluble hæmaglobin and was transformed in the cornea into an insoluble salt..

Burnett.

MISCELLANEOUS NOTES.

ANNOUNCEMENT OF BOOKS.

LEA BROTHERS & Co., Philadelphia, have brought out the following three books, which we heartily recommend to our readers:

I. **A Text-Book of Ophthalmology.** By WM. F. NORRIS, A.M., M.D., Prof. of Ophthal. University Penna., Surgeon to Wills' Hosp.; and CHAS. A. OLIVER, A.M., M.D., Surgeon to Wills' Hosp. Illustrated with 5 colored plates and 357 woodcuts. Price: Cloth, $5.00; leather, $6.00.

This is one of the most carefully prepared text-books on the eye which modern times, so fertile in good text-books, have brought to light. The learned and experienced authors have been occupied with it seven years, and the work bears testimony that it was time well spent. Embryology, macroscopic and microscopic anatomy fill 79 pages; physiology, 23, with good drawings. Catoptrics, dioptrics, and physiological optics occupy 58 pages, with an abundance of figures. Yet the text is completely elementary, and within the ken of every medical student. The examination of the eye (62 pages) is very good. The determination and correction of the errors of refraction receive 58 pages. This first part, 280 pages, has been written by Dr. Oliver.

The remainder of the work, 341 pages, is by Dr. Norris. It comprises the organic lesions of the eye and its adnexa, and "some of the more common and important operations on the eye." The numerous figures illustrating and supplementing the descriptions are carefully selected, and most of them are familiar to the ophthalmic reader. Between the diseases of the ciliary body and cataract a chapter (vii.) on accommodation, emmetropia, hypermetropia, myopia, and astigmatism is intercalated. The affections of the eye-muscles and their operative treatment receive due consideration.

The whole treatise shows that the literature has been extensively and judiciously utilized, though the work has by no means the character of a compilation, but shows the individuality of its authors, especially that of the senior, in every subject.

H. K.

II. **A Handbook of Ophthalmic Science and Practice.** By HENRY E. JULER, F.R.C.S., Ophthalmic Surgeon to St. Mary's Hospital, Surgeon to the Royal Westminster Ophthalmic Hospital, London. New (second) edition, revised and enlarged. In one handsome octavo volume of 562 pages, with 201 engravings, 17 colored plates, test-types, and color-blindness test. Cloth, $5.50 ; leather, $6.50.

Juler's book, even in this new edition, is less extensive than the preceding, but what it contains is excellently well presented. Print and illustrations are superb. H. K.

III. **A Dictionary of Medical Science.** Containing a full explanation of the various subjects and terms of Anatomy, Physiology, Medical Chemistry, Pharmacy, Pharmacology, Therapeutics, Medicine, Hygiene, Dietetics, Pathology, Surgery, Bacteriology, Ophthalmology, Otology, Laryngology, Dermatology, Gynecology, Obstetrics, Pediatrics, Medical Jurisprudence, and Dentistry, etc., etc. By ROBLEY DUNGLISON, M.D., LL.D., late Professor of Institutes of Medicine in the Jefferson Medical College of Philadelphia. Edited by RICHARD J. DUNGLISON, A.M., M.D. New (21st) edition, thoroughly revised, greatly enlarged and improved, with the Pronunciation, Accentuation, and Derivation of the Terms. In one magnificent imperial octavo volume of 1181 pages. Cloth, $7.00 ; leather, $8.00.

We have used this popular dictionary for many years. It has progressed with the development of medical science and is brought fully up to date. For the conscientious and busy physician, with his scant allowance of reading time, it has the threefold advantage of being *exhaustive*, *concise*, and *convenient*. H. K.

IV. A new treatise, in French, deserves particular attention as being eminently opportune, namely :

Études sur les Tumeurs de l'Œil, de l'Orbite et des Annexes. By Dr. FÉLIX LAGRANGE, adjunct professor to the

Medical Faculty of Bordeaux. Paris: G. Steinheil, 2 Rue Casimir del Vigne, 1893. Price, 8 francs.

This nicely printed octavo volume of 276 pages, with 9 lithographic plates and 16 figures in the text, treats in a most attractive way of all the ocular and periocular tumors that come before the practitioner. The first part is devoted to the epibulbar and peribulbar growths, especially sarcoma and epithelioma, 80 pages; the second part to the intraocular tumors (myoma, primary carcinoma of the ciliary body, tubercles, sarcoma, and glioma); 144 pages. The third part treats of tumors of the orbit and the adnexa oculi, with their operations; 53 pages. Though the work does not exhaust its subject, and is open to criticism in many places, it is unusually instructive and can be highly commended. H. K.

V.—An outline of the **Embryology of the Eye,** with illustrations from original pen-drawings by the author. By WARD A. HOLDEN, A.M., M.D., Assistant Surgeon New York Ophthalmic and Aural Institute, Clinical Assistant Vanderbilt Clinic. The Cartwright Prize Essay for 1893. G. P. Putnam's Sons, New York and London, 1893. Price, cloth, 75 cents.

Dr. Holden has embodied in an exceedingly neat, small octavo volume of sixty-nine pages, profusely illustrated with drawings in the text and on twelve plates, a concise description of the development of the eye. The treatise, though naturally leaning on incident literature, is altogether based on original investigations made in the Laboratory of the New York Ophthalmic and Aural Institute.

It will be a welcome addition to the library of the oculist who wants to inform himself in the fundamental doctrines of his profession. Embryology, insufficiently taught at college, and little, if at all, mentioned in text-books, usually is a gap in our knowledge which we feel unpleasantly when we have to diagnosticate or explain the numerous congenital defects and anomalies of the visual organ.

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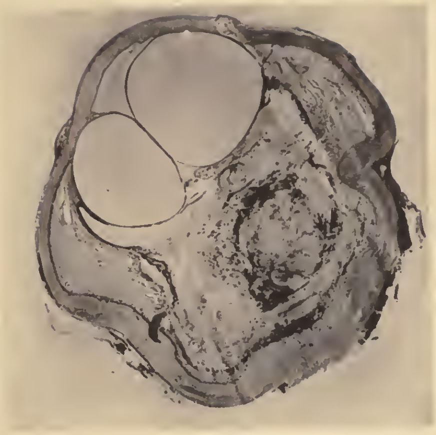

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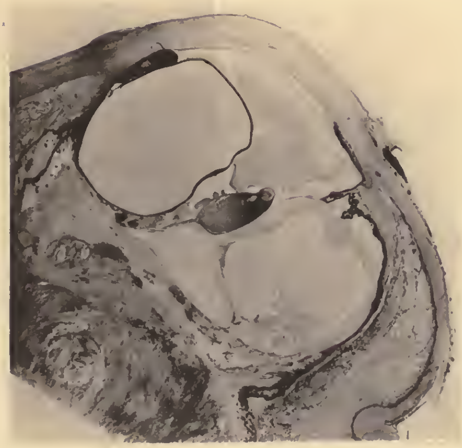

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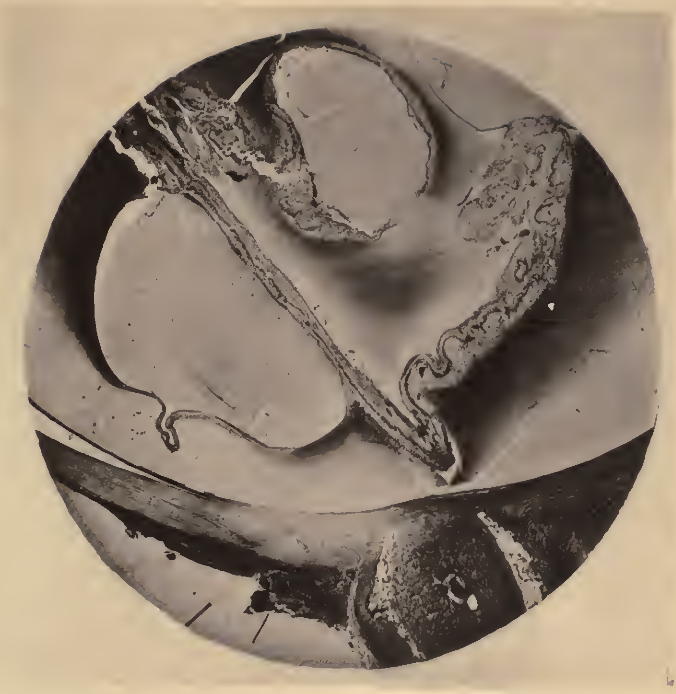

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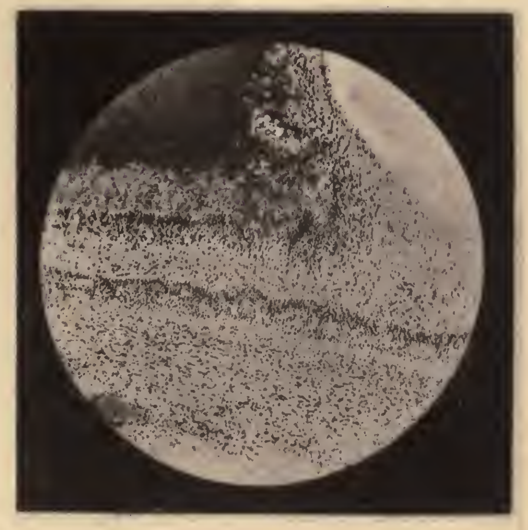

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